ARTICLES on design, construction and operation of oil-engines and motorships by the world's foremost writers on marine engineering.

Motorship

ILLUSTRATIONS of the newest designs in international merchant motorship and Diesel-engine construction and auxiliary equipment.

Vol. X New York, September, 1925 No. 9

Big Diesel Engined Ferry for Seattle

Kitsap, 526 Tons Gross and 600 s.hp. with a Capacity of 75 Autos and 800 Passengers is Commissioned for Puget Sound Service

AN outstanding full Diesel automobile ferry built on the Pacific Coast during 1925 is the KITSAP, recently put into commission on Puget Sound by the Kitsap County Transportation Co. This boat, which ranks as the largest Diesel automobile ferry north of San Francisco and one of the largest in the United States, operates on an hourly run from Fontleroy, West Seattle, to Harper, on the Olympic Peninsula.

This new ferryboat is 165 ft. length overall by 49 ft. 9 in. extreme beam and 9 ft. 9 in. loaded draft, 526 tons gross, 358 tons net. Powered with a 6-cylinder 600 b.hp. Washington-Estep engine, she is proving to be a very economical boat to operate. Her design was evolved by Captain J. L. Anderson, president of the Kitsap County Transportation Co., and is the result of many years' experience in ferry construction and operation. She was built by the Lake Washington Shipyards at Houghton, Wash.

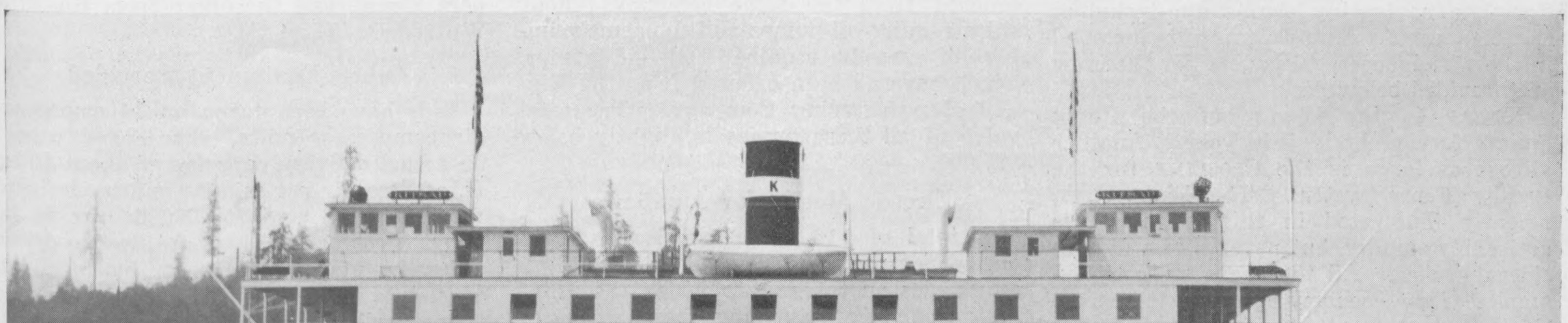
The layout of the craft shows that she is of the most modern design and that her arrangements have been worked out so that with a full load of autos aboard she can unload them all in a short time and quickly load up for the next trip. She has a capacity of about 75 automobiles and over 800 passengers. The cars are loaded in two rows three abreast on the lower deck on either side of the engine casing. The passenger deck is 106 ft. long, with cabins and smoking room amidships.

End view of motorferry Kitsap

Hull and superstructure are of wood, strongly built and well finished. The hull is divided into five compartments by watertight bulkheads. It is believed that any one of these compartments might become filled with water without endangering the vessel. Ample fire protection is provided in the form of extinguishers and 700 ft. of hose connectable to any one of the several pumping units.

The engine room is 43 ft. long by the full width of the ship. The main engine is in the center, and the auxiliaries conveniently grouped around it. The engine room casing, built of steel, forms an important addition to the strength of the vessel, being a support for the upper deck and also carrying the mufflers and exhaust pipes. A set of travelling cranes are supplied above the main engines. These will be of great convenience to the engineers when working on the main engines or auxiliaries. Doors are provided in the ends of the casings so that weights can be landed on the main deck with only one handling from the engine room.

A 6-cylinder Washington-Estep engine developing 600 b.hp. at 200 r.p.m. propels the boat. The manufacturers state that it is the largest airless injection Diesel engine



Kitsap, the new Diesel engined ferryboat, furnishes another example of the inroads of the oil engine into the steam domain

and built under American patents on the Pacific Coast. It operates on the 4-cycle principle with the low compression of 350 lb. per sq. in. and needs only 200 lb. of starting air pressure. The solid injection system consists of high pressure pumps delivering the fuel oil to the injection nozzles through patented purifiers which prevent the fuel nozzles clogging. A double system of full force feed lubrication for the main bearings and other working parts is provided. A mechanical oiler furnishes cylinder oil to the cylinder walls for lubrication.

To insure the purification of all lubricating oil the owners of the KITSAP have installed a De Laval oil purifier in the engine room. While the vessel has not as yet been in operation long enough for positive figures on the lubricating oil consumption to be available, it is expected that the installation will effect a marked economy in the consumption as well as contribute to the more efficient operation of the engine.

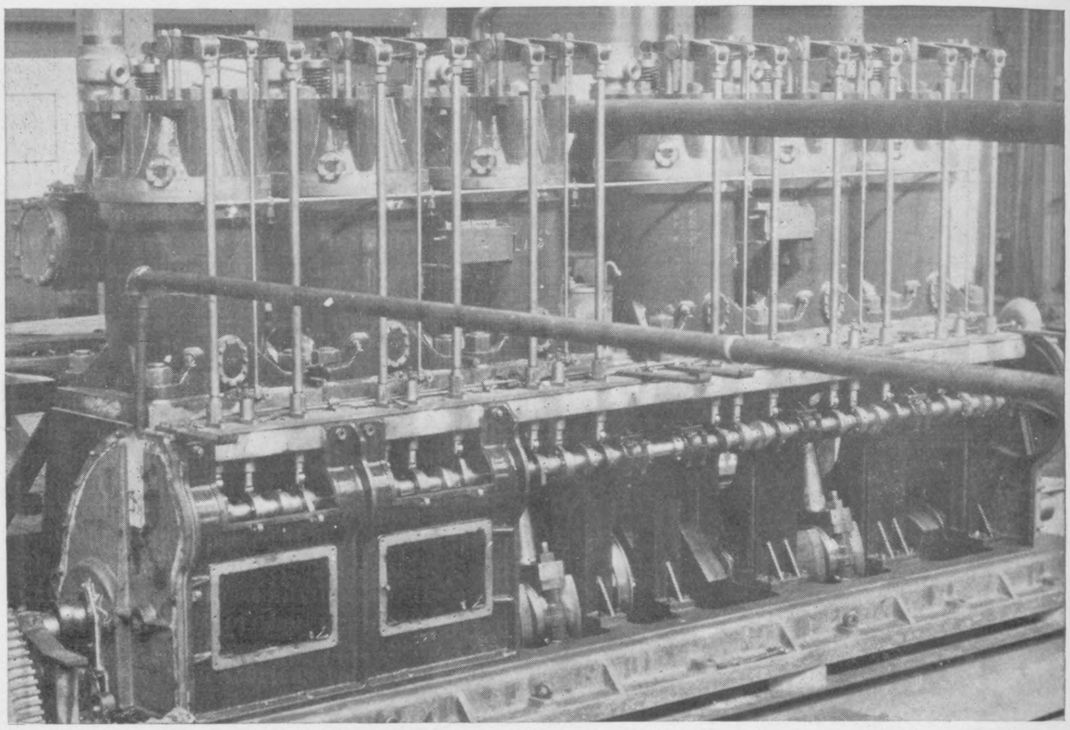
The main auxiliary unit is a 12 hp. Cummins engine which drives the single stage air compressor and is direct connected to an 8 kw. generator. There is also a 7½ kw. generator belted to the main engine. Ninety cells of Edison storage batteries, making 110-volt system, float on the line.

The pumping equipment is very complete. There is a main bilge pump driven by a 15 hp. motor, an independent pump ordinarily used to operate the sanitary system of the vessel and a pump which is chain-driven off the main engine for furnishing circulating water to the cylinders. The pumps are cross connected, so that in the event of a breakdown any one of the pumps may be made to perform the functions of any other. A Delco water system is installed for handling the fresh water supply. There is also a hot water system for heating all parts of the boat.

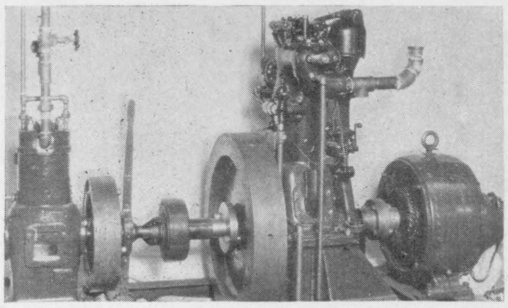
The KITSAP is what is known as a double-end ferry, there being a propeller and rudder at either end, the former clutch connected to the engine. The fuel tanks carry 6300 gal., this large capacity being provided to eliminate the necessity of frequently taking the boat out of commission for refueling.

Two wheelhouses are provided, with captain's and engineers' quarters adjacent. Complete navigating equipment, including electric engine room telegraphs, is installed in the wheelhouses. Quarters for the crew are provided below deck.

KITSAP is the largest of the Puget Sound ferries built this year. Another almost as large is the CROSLINE for the Crosby Ferry system. The WOLLOCHET, recently illustrated in this magazine, is noticeably smaller, but nevertheless of considerable size. All three are striking examples of the economy of oil-engine operation in extremely short runs.



Kitsap's 600-hp. airless injection engine on the test floor



Kitsap's auxiliary compressor and generator set

Equipment for U. S. S. B. Diesel Ships

Pump Outfits Ordered

AWARDS have been made for the pumps required in connection with the Diesel conversion program of the Shipping Board. Owing to variations in the designs of the main engines to be installed in these vessels, there are slight differences in the pump equipment of the different ships. All the vessels will, however, be required to have independent fire and bilge pumps, engine room bilge pumps, fresh water and salt water sanitary pumps, circulating water pumps and spares for water pumps. The contracts for all these have been let to the Nash Engineering Company, which was the lowest bidder. Only two vessels require separate piston cooling pumps and only two vessels will need separate fresh water cooling pumps. This equipment was ordered from the same company. Four ships require oil pumps and the same number of vessels require fuel oil pumps, which have all been ordered from the Kinney Manufacturing Company. The total value of all these pumps is slightly below $75,000.

Electric Motors for Auxiliaries

A total of 116 electric motors are required for the operation of the underdeck auxiliaries on the vessels which the Shipping Board is converting from steam to Diesel power. This total is composed of 30 motors of 30 hp., 18 motors of 20 hp. and 68 motors of 7½ hp. The bids of the General Electric Company and of the Electro Dynamic Company were very close, the difference between them being less than $400. The award is still to be announced.

Heating Boilers

Only two firms responded to the call for bids on heating boilers for the 14 vessels. The American Radiator Company quoted a price of $887 each on cast iron sectional heating boilers. The Newport News S. B. & D. D. Co. quoted on steel vertical fire tube boilers at a price of $2700 for the first and $1900 for each additional with corrugated fire box design, or $2600 for the first and $1775 for each additional with plain fire box design. No award has yet been made.

Torsion Meters

All the vessels that are to be converted will be equipped with torsion meters for direct reading of the shaft hp. These instruments have very seldom been installed in motorvessels except for trials. They are undoubtedly a desirable addition to any vessel's equipment, but engineers will require a special course to ensure the fullest benefit being derived from the use of these torsion meters. Two bids have been received, one from the McNab Co. of Bridgeport, Conn., and the other from Kelvin & Wilfred O. White Co.

Other Equipment Specified

Bids have been taken on 14 emergency air compressor units. These are to have an actual delivery capacity of about 10 cu. ft. of free air per minute and be designed for delivering against 1000 lb. per sq. in. gauge pressure. They are to be driven either by a steam engine or by an oil engine, but a requirement is made that the latter shall not employ any external heating device. An alternative proposal is also asked for an oil engine driving an emergency air compressor of the capacity and type above specified with the addition of a generator of approximately 14 kw. capacity on the other end of the engine shaft for port lighting purposes.

Specifications have been issued for four fresh water coolers and 29 oil coolers to be used in connection with the main engines of the different vessels, and bids have also been called for on the switchboards and control boards for the electrical systems.

American Petroleum Supply and Demand

Report of the Committee of the American Petroleum Institute for Presentation to the Federal Oil Conservation Board

A REASSURING report as to the supply of petroleum in the United States prepared by a committee of eleven of the directors of the American Petroleum Institute was transmitted to the Federal Oil Conservation Board at Washington last month by J. Edgar Pew, President of the Institute.

The report states it is reasonable to assume that the oil resources of the United States, including oil from wells, shale, coal and lignites, assure the country of a sufficient supply of motor fuel and lubricants for the national defense and for essential uses beyond the time when science will limit the demand by developing more efficient use of, or substitutes for, oil, or will displace its use as a source of power by harnessing a natural energy.

The committee states: "The discovery of crude oil—which is the beginning of the oil industry and on which so much depends—is not an exact art. Oil is hidden—the industry is essentially a finding industry, attended with great uncertainties in the search. The future supply of crude oil cannot be blocked out and drawn upon as needed as in the case of oil shales, coal and lignites, from which liquid fuel can be extracted, and of many other minerals. Favorable looking lands become oil fields when the drill has revealed the presence of oil, and only then. Hence predictions of future supply of crude oil are necessarily conjectural. Speculative, also, perhaps to a greater degree, must be estimates of future demand, depending as they do upon conditions which, with the advance of science and invention, may undergo unforeseen and radical changes. Conclusions of the Committee are based on the best information obtainable, within and without the industry."

The summary of conclusions follow:

1. There is no imminent danger of the exhaustion of the petroleum reserves of the United States.

2. It is reasonable to assume that a sufficient supply of oil will be available for national defense and for essential uses in the United States beyond the time when science will limit the demand by developing more efficient use of, or substitutes for, oil, or will displace its use as a source of power by harnessing a natural energy.

3. Current supply and demand cannot stay in balance, since the amount of both supply and demand are constantly changing. Generally, current supply will exceed or be less than current demand, creating surplus or shortage; either condition will be reflected in price, but price will in time correct either condition.

4. Petroleum recoverable by present methods of flowing and pumping from existing wells and acreage thus proven consist of five billion three hundred million (5,300,000,000) barrels of crude oil.

5. It is estimated that after pumping and flowing there will remain in the area now producing and proved twenty-six billion (26,000,000,000) barrels of crude oil, a considerable portion of which can be recovered by improved and known processes such as flooding with water, the introduction of air and gas pressure and mining, when price justifies.

6. Improved methods of deep drilling below oil sands now producing will disclose in many areas deposits not hitherto available, which will be tantamount to the discovery of new fields. Improved methods of producing have been perfected which will make possible recovery of oil from these lower levels. The limit of deep drilling has not been reached.

7. The major oil reserves of the United States lie in some one billion, one hundred million (1,100,000,000) acres of lands underlain by sedimentary rocks, and not fully explored, in which geology indicates oil is possible. With extended search new supplies will be found therein.

8. The Nation has an additional reserve in the vast deposits of oil shale, coal and lignites from all of which liquid fuel and lubricants may be extracted if and when the cost of recovery is justified by the price of these products. These deposits are so huge that they promise, under conservative estimates, an almost unlimited supply.

9. While this report is confined to the petroleum supply and demand within continental United States the importance of imports cannot be ignored. Countries to the south are known to have large petroleum resources, for the output of which the United States it a natural market and the supply therefrom must inevitably have its influence on the consumption of American reserves.

10. The availability of future petroleum supplies from the vast area of land mentioned above depends upon adequate incentives to the exploration which in the past has given the Nation a sufficient supply of petroleum, in peace and in war, throughout the history of the oil industry. from its inception in 1859. There must be:

(a) Security in the ownership of oil lands and of the right to lease.

(b) Conditions of exploration and development by owners or lessees permitting exercise of initiative, liberty of action, the play of competition and the free operation of the law of Supply and Demand.

(c) Prices that will provide a return to producers, refiners, and distributers commensurate to the risks involved and the capital invested.

11. The supply of petroleum will be made to go much further through more efficient utilization. Automotive experts state that the mileage of the motor car per gallon of gasoline may be doubled through structural mechanical changes, when price justifies such changes. Improved mechanics will also result in smaller consumption of lubricants.

12. Through improved methods, principally the process known as "cracking," the refining branch of the industry has already increased the yield of gasoline, now the major product of petroleum. Through further improvements and extensions the supply of gasoline will be augmented still further by the "cracking" of fuel oil. In consequence the supply of fuel oil will be correspondingly diminished, thus eventually removing fuel oil from competition with coal.

13. Waste in the production, transportation, refining and distribution of petroleum and its products is negligible.

The members of the committee which prepared the report are:

J. Edgar Pew, President, American Petroleum Institute, New York; Vice-President, Sun Oil Company, Dallas, Tex.

E. W. Marland, President, Marland Oil Company, Ponca City, Okla.

D. M. Folsom, Director, General Petroleum Corporation, San Francisco.

E. T. Wilson, Chairman of the Board, Continental Oil Company, Denver.

K. R. Kingsbury, President, Standard Oil Company (California), San Francisco.

George S. Davison, President, Gulf Refining Company, Pitsburgh.

W. S. Farish, President, Humble Oil & Refining Company, Houston.

J. C. Donnell, President, Ohio Oil Company, Findlay, Ohio.

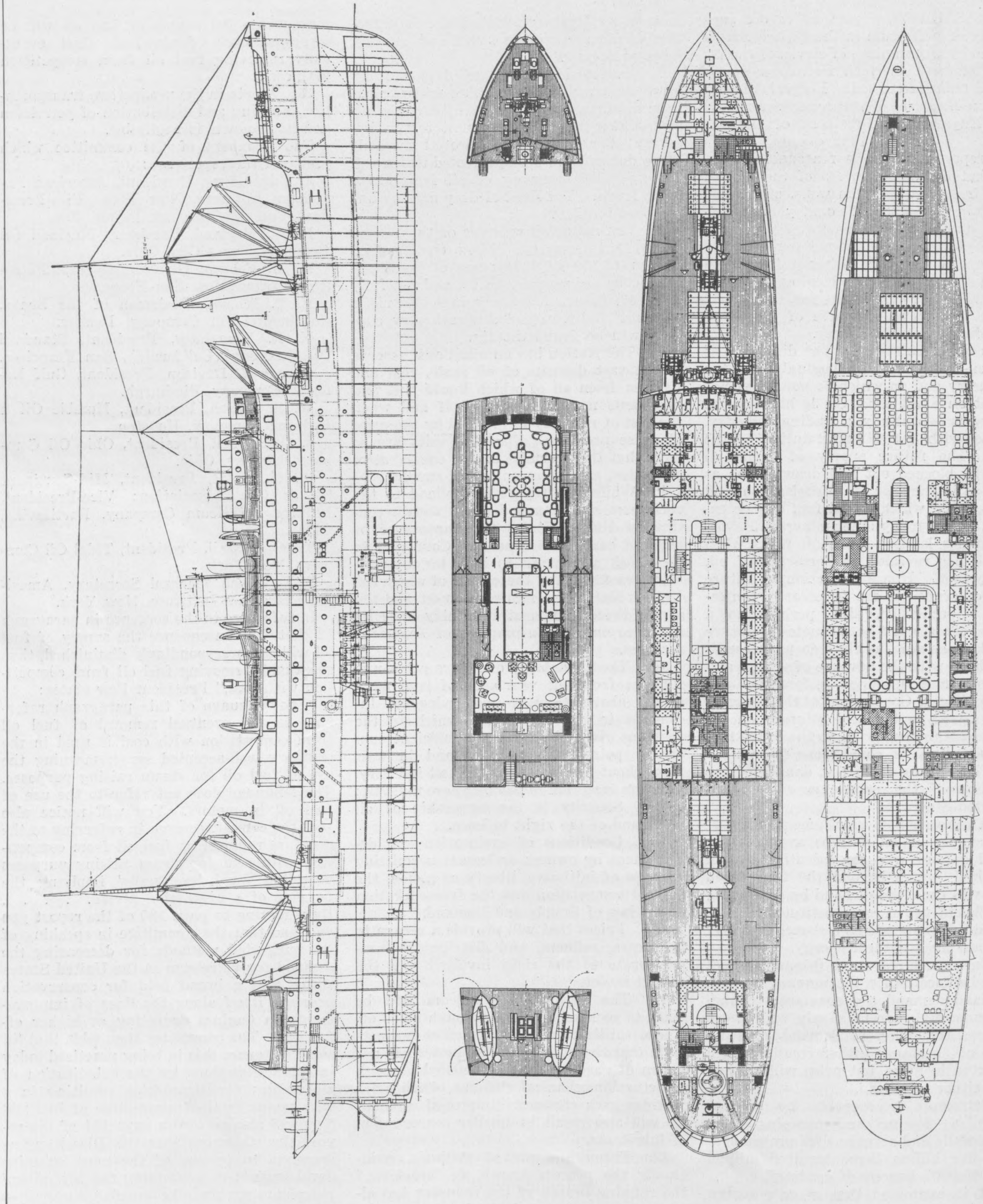
W. N. Davis, President, Mid-Continent Oil & Gas Association; Vice-President, Phillips Petroleum Company. Bartlesville, Okla.

Frank Haskell, President, Tidal Oil Company, New York.

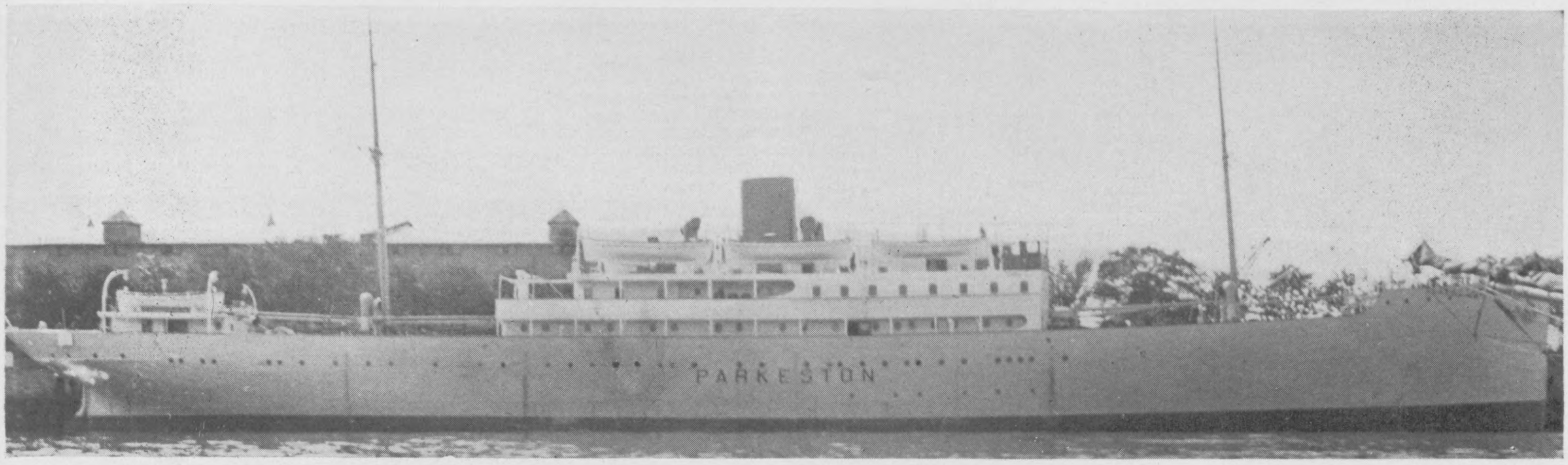
R. L. Welch, General Secretary, American Petroleum Institute, New York.

In reference to the sentence in paragraph 12 that "in consequence the supply of fuel oil will be correspondingly diminished, thus eventually removing fuel oil from competition with coal," President Pew states:

"The language of this paragraph referring to the eventual removal of fuel oil from competition with coal is used in the ordinary well-accepted sense, meaning the use of fuel oil for steam raising purposes. The language does not refer to the use of fuel oil in motors. You will notice also that the committee even in referring to the eventual removal of fuel oil from competition with coal for steam raising purposes uses the word 'eventually' implying the passage of a protracted period. . . . . By referring to page 180 of the report you will find that the committee in speaking of the suggested methods for decreasing the demand for petroleum in the United States states that a broad field for conservation presents itself along the lines of improvements in engines operating at higher efficiency. The committee then adds that 'in some instances this is being practiced today in other directions by the substitution of motorships for steamships resulting in a vast saving in the consumption of fuel oil.' You will also notice on page 181 of the report the statement that the Diesel engine promises to be one of the most effective developments in prolonging the life of our petroleum supply—the popular gas engine now utilizes about 25 per cent of the crude whereas the Diesel engine would utilize 100 per cent of the crude, and the gas engine has only approximately two-thirds the thermal efficiency of a Diesel engine."



Profile and deck plans of t.s.m.s. Parkeston, 2760 tons gross, 15 knots. Owners, Det Forenede Dampskibs-Selskab A/S, Copenhagen



Parkeston, the new passenger and freight motorvessel of the Royal Danish Mail Route between Denmark and England

A 15-Knot 2760-Ton Passenger Vessel

Placed on a 24-Hour Run Across the North Sea by a Danish Steamship Company

ANOTHER chapter is being added to the story of short-run shipping in general and to the North-Sea passenger traffic in particular by the introduction of a motorship on the Royal Danish Mail Route between Harwich, England and Esbjerg, Denmark. This ship, the PARKESTON, is the first of its kind to be employed in the British-Continental services, and every confidence is felt that this motorvessel, having a relatively high power for her size, will prove equally successful on this short run —the normal passage is 24 hours—as motorships of much larger tonnage, but lower speed, have shown themselves to be on the ocean.

The Harwich-Esbjerg route has been established for over 45 years, originally in connection with the Great Eastern Railway Co., now the London & North Eastern Railway Co., while in Denmark there is connection with the train service of the Danish State Railways. The route affords the most direct and convenient link of travel between England and Denmark/Scandinavia. It is operated by Det Forenede DS. S. A/S (United S. S. Co., of Copenhagen), a company owning 121 vessels aggregating 219,457 tons gross, operating all over the world.

By the inclusion of the PARKESTON in the Harwich-Esbjerg service there will be sailings every weekday in both directions, maintained by the following vessels:

SHIP	GROSS REGISTER	POWER
m.s. PARKESTON	2761 tons	3800 i.hp.
s.s. A. P. BERNSTORFF.	2316 tons	3300 i.hp.
s.s. DRONNING MAUD.	1779 tons	2450 i.hp.
s.s. J. C. LA COUR...	1635 tons	3600 i.hp.

PARKESTON was built by the Elsinore Iron Shipbuilding and Engineering Co. and is equipped with B. & W. engines. She is of the awning deck type and has been specially constructed for the carriage of passengers, mail and cargo from Denmark to England and vice versa.

Her principal dimensions are as follow:

Length, overall	321 ft. 0 in.
Length, b.p.	304 ft. 0 in.
Breadth, molded	44 ft. 0 in.
Depth to awning deck	28 ft. 6 in.
Draught loaded	17 ft. 3 in.
Displacement	3805 tons
Gross register	2761 tons
Net register	1572 tons
Deadweight capacity	about 1500 tons

The total capacity of the holds is about 88,000 cu. ft., of which about 50,000 cu. ft. have been insulated and refrigerated, making these holds fit to carry Danish agricultural produce even in the height of the summer.

The fuel oil for the Diesel engines is carried in two deep tanks forward of the engine room, whereas the double bottom, which extends the entire length of the hull, is fitted partly for the carriage of water ballast and partly for lubricating oil.

By means of six transverse bulkheads the hull is divided into seven watertight compartments, enabling the vessel to float even if two adjoining compartments are in direct communication with the sea.

Accommodation for first-class passengers is situated amidships and is excellently arranged. The awning deck, main deck and 'tween deck each has a range of cabins, chiefly fitted out as single-berth and two-berth cabins, only a few rooms being provided with three or four berths. Besides having the usual equipment of the latest type, the cabins are provided with direct supply of hot and cold water, while bathrooms and lavatories are arranged on all decks. A total of 124 first-class passengers can be carried, of whom nearly half are accommodated in deck cabins.

The public rooms consist of dining saloon, smoking saloon and music room, and there is spacious deck accommodation on the promenade and bridge decks.

The dining room, placed on the main deck, occupies the whole width of the vessel and seats 87 passengers. Panel doors and furniture are finished in polished birch.

The smoking room is situated at the fore end of the promenade deck and is unusually spacious for a vessel of this size, providing accommodation in comfortable armchairs and sofas for in all 50 passengers. The woodwork is finished in polished mahogany.

The music room is arranged at the after end of the promenade deck. The decorations of this room are carried out in a greyish-mauve color, and the ceiling, which has a broad dome effect, is richly decorated.

In the design of the passenger accommodation particular attention has been paid to the hygienic requirements. The use of rubber in corridors, on the stairs and on the floors of the dining room and smoking room render it possible to have the cleaning performed in the most effective manner.

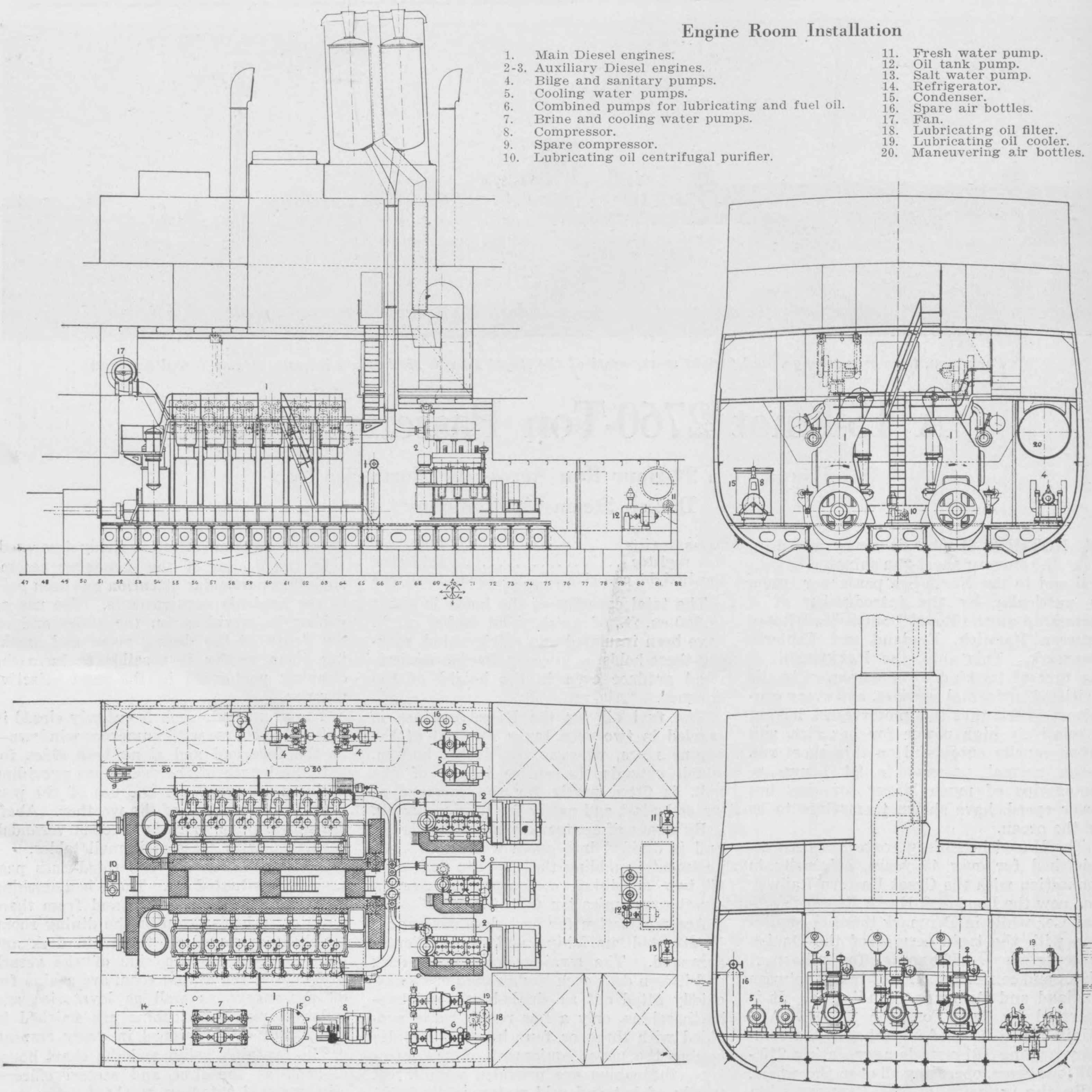
The promenade deck is entirely closed in —fitted of course with numerous windows— at the fore end and along both sides for half the length of the deck, thus providing a closed verandah for the use of the passengers irrespective of the weather. Abaft the music room there is an open verandah furnished with seats and small tables.

Accommodation for the third-class passengers is situated aft. There is a smoking room on the awning deck, and from there a stairway leads down to the dining room, which is arranged on the main deck and extends from side to side of the vessel. Forward of the dining room are cabins for 88 passengers as well as lavatories and toilet rooms. The cabins are finished in white and well equipped in every respect.

The captain's cabin and the chart house as well as the first and second officers' cabins are situated on the boat deck; part of this deck is also available for the passengers. For the other officers the cabins and mess room have been arranged on the awning deck, while the deck, engine and restaurant crew is accommodated in various other places.

The vessel is heated partly by hot air and partly by steam radiators. By means of two large centrifugal blowers the hot air is blown into the first-class accommodation, ensuring an even and agreeable temperature in winter, at the same time rendering the ventilation of the rooms very effective. This ventilation also ensures a cool and agreeable atmosphere in summer.

The vessel is equipped with 6 powerful electrically driven cargo winches as well as electric windlass and electric capstan aft for warping purposes. The rudder is worked by a steering gear of the electric-hydraulic type controlled from the bridge by means of a telemotor.



Elevation, plan and sections of the engine room of the short run passenger motorvessel Parkeston

The main-machinery consists of two 6-cylinder Diesel engines built by Burmeister & Wain, and specially constructed for fast passenger ships. The motors are of the 4-cycle enclosed, direct reversible, trunk-piston type, with cylinder diameter of 21.65 in. and a stroke of 35.43 in. Under normal conditions at sea the engines develop 3800 i.hp. at 190 r.p.m.

In accordance with Burmeister & Wain practice the crankshaft is built up and fitted with counterweights to balance the free moments in each group of three cylinders.

The cylinder covers are of the latest square type, bolted together and held down to the columns by staybolts fastened to the bedplate. A chain drive for the camshaft is arranged at the forward part of the engine near the flywheel, this drive at the same time serving for the fuel-oil pumps, of which there is one for each cylinder. The camshaft is on the top of the engine and its bearings have ring lubrication.

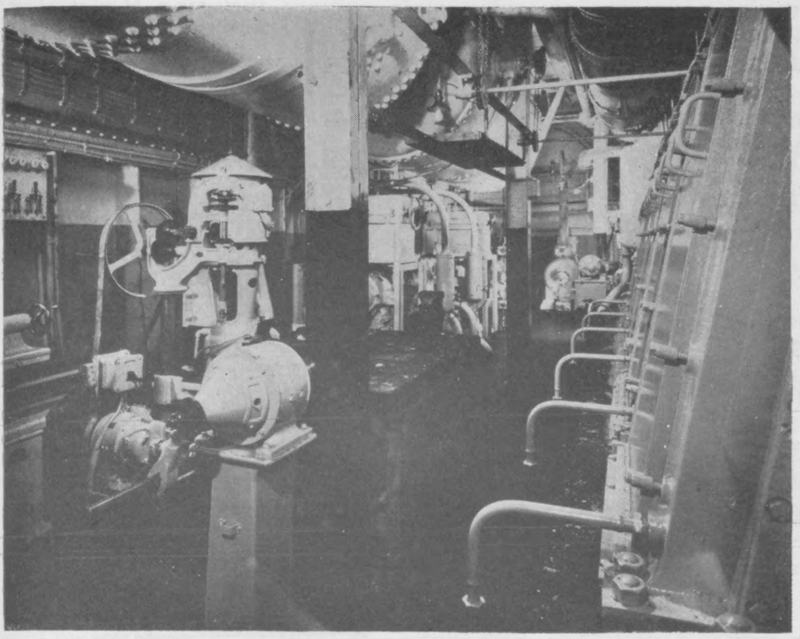
Oil is used for cooling the pistons, being led to and from the pistons through telescopic pipes.

A 3-stage air compressor is fitted at the after end of the engine, its crankshaft being connected by a flange coupling to the main crankshaft and having collars for the thrust-bearing, which is of the Burmeister & Wain special type, with forced lubrication and connected direct to the main engine. The bearing has two shoes, one of which is sufficient to take the whole thrust. By fitting the thrust-bearing in the main-engine itself a not inconsiderable space is gained, and at the same time the arrangement of the oil supply has been simplified.

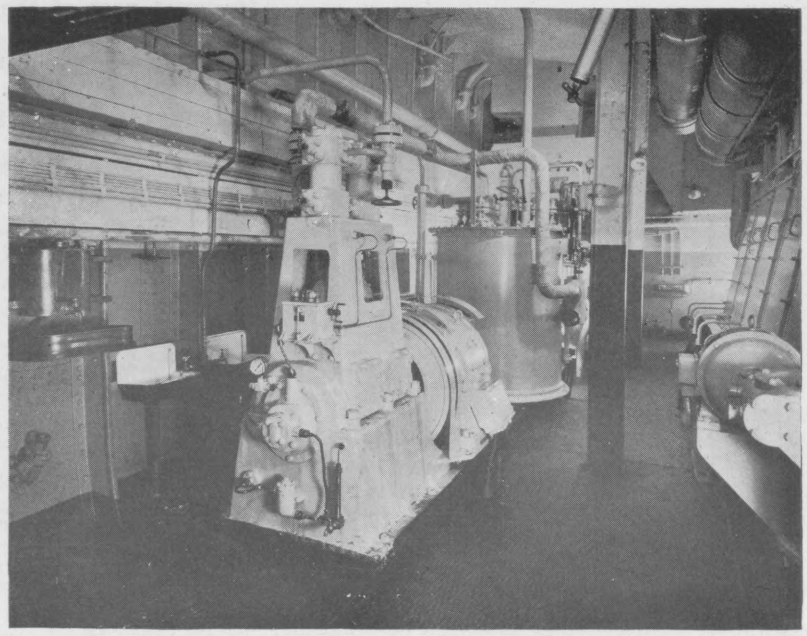
Only the air compressor and fuel-pumps are driven by the main-engines. Everything else is electrically driven on deck as well as in the engine room.

To provide the current for the auxiliary engines, light, winches, steering engine, etc., three Diesel engines are installed, namely, two 3-cylinder engines of 150 b.hp. at 400 r.p.m. and one 2-cylinder engine of 100 b.hp. at the same speed, direct-connected to the generators. The diameter of all cylinders is 12.20 in. and the stroke is 13.78 in.

The air compressors of the auxiliary engines are fitted with a patented system for regulating the amount of air compressed. By this system the compressors under normal conditions can be adjusted to give the amount of air necessary for the injection of fuel-oil in the engine itself, while



Port wing of Parkeston's engine room



Starboard wing of Parkeston's engine room

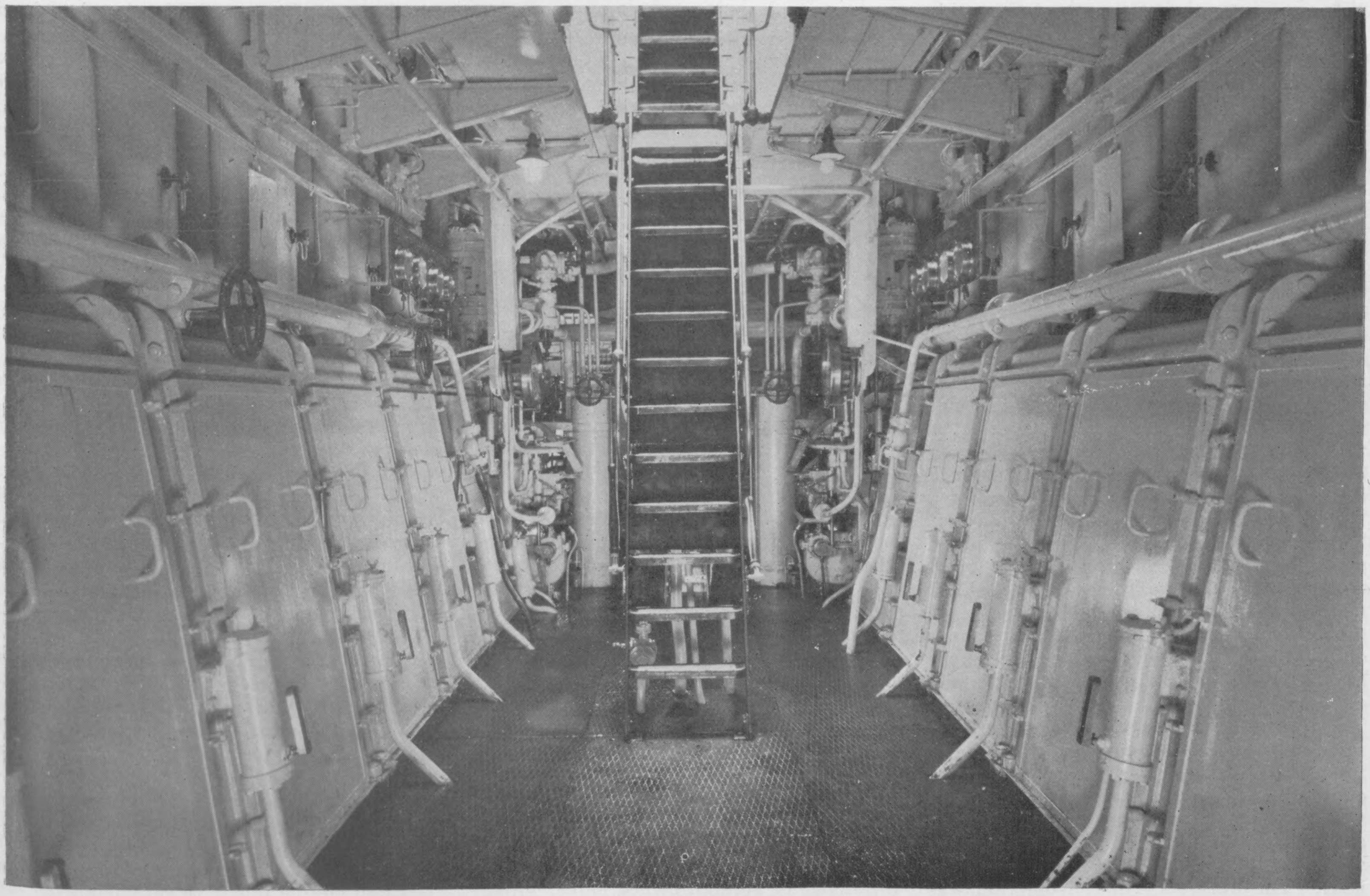
if necessary, the output can be raised so that the compressors give sufficient air for one main engine if its compressor happens to be out of action, and a third arrangement can be used for supplying the maneuvering air necessary for the main engines. The maneuvering air has a pressure of 360 lb. per sq. in. and is stored in two air tanks fitted below the deck on the port side of the engine room.

The main engines, as well as each auxiliary, have a bottle for injection air at a working pressure of 870 lb. per sq. in. All the bottles are connected to one pipe, which is led to two spare bottles, from which any of the other bottles can be filled. Each bottle can be filled from the compressor of any of the main or auxiliary engines; further, the pipe is led to a special hand-pump from which the bottles of any of the auxiliary engines can be filled for a first start, if all the air has gone, for instance in case of laying up.

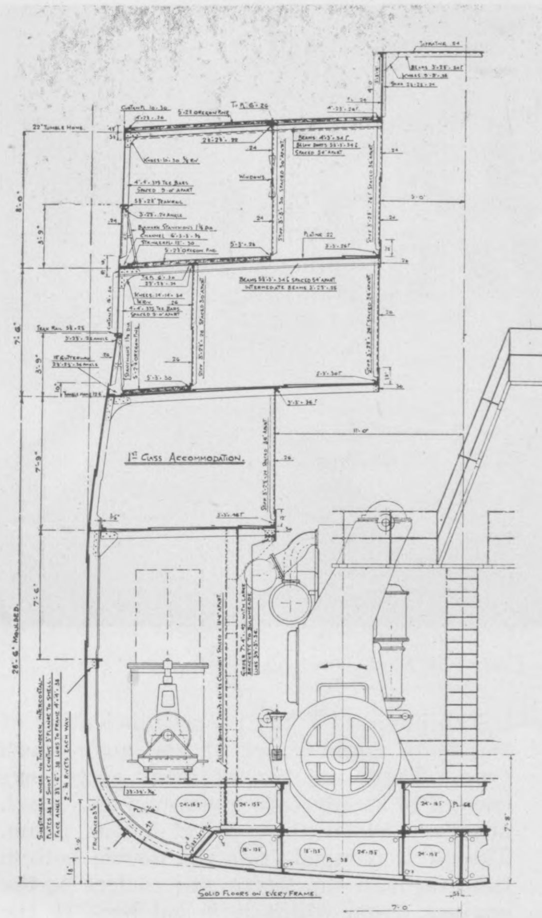
There are two centrifugal pumps for circulating the cooling water in the main and auxiliary engines. Each pump is large enough for cooling all the engines under full load at the same time.

The pumps for the forced lubrication of the main engines are of the gear wheel type. There are two of them, each large enough to supply both main engines. Each auxiliary has its own direct driven pump. The oil is pumped from the double bottom tank through the filters and coolers to the engines, from which it is led back to the main tank.

A fuel oil transfer pump is coupled to the opposite end of the electric motors which drive the lubricating oil pumps. The two pumps draw from the two deep tanks, each of a capacity of about 35 tons, placed in the



Looking aft between the main Diesel engines of the 15 knot passenger motor vessel Parkeston built for the North Sea service of a Danish company

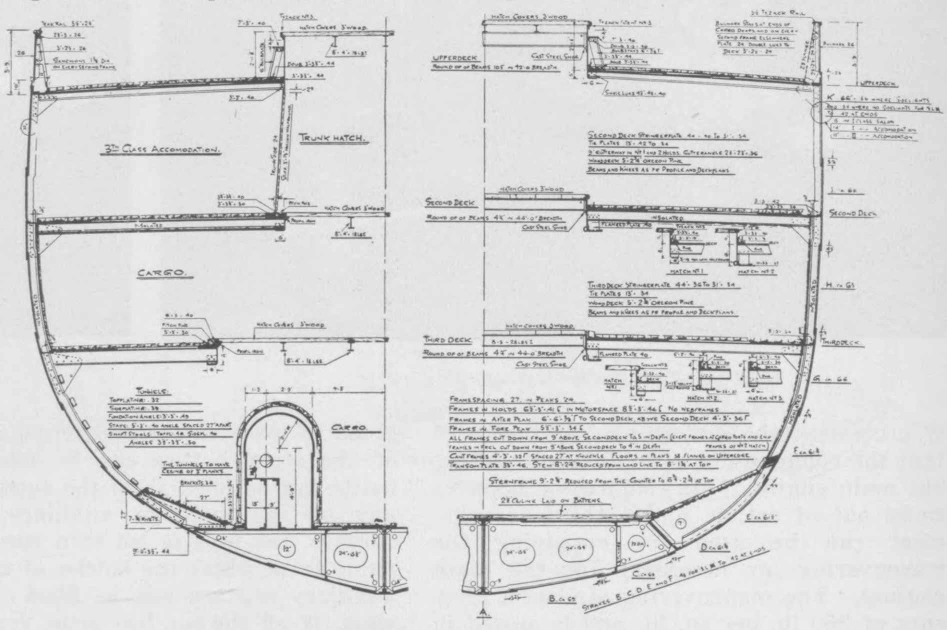


forward part of the engine room, one on each side. The fuel oil is pumped to a service-tank above the main engines which is kept constantly filled.

Supercharging is provided for the main engines with an air pressure in the inlet manifold of about 20 in. of water, maintained by two centrifugal fans, one for each engine.

Weight of the main engines is 236 tons, and the weight of the complete machinery, viz.: main engines including thrust-bearings, shafting, stern-tubes, propellers, etc., auxiliary engines, air-vessels, silencers, air-bottles, all electrically driven pumps necessary for the motors, piping and spare parts, is 415 tons.

On the sea-trials the maximum speed attained by the ship was 15.72 knots at 4410 i.hp. and the Parkeston showed herself practically free from the vibration usually encountered when steam engines are used.



SECTION THROUGH MOTOR-ROOM

SECTION THROUGH HOLDS

These sections through the t.s.m.s. Parkeston show what a staunchly built little ship she is and show also the insulated holds

M. S. Silveray

ANOTHER vessel of the SILVER series was completed recently and made her first call at an American port last month. She is the SILVERAY, and will operate with the SILVERELM, SILVERFIR and SILVERCEDAR between America and the Far East in conjunction with the vessels of the Kerr S. S. Co. Inc., of New York, operating as the Roosevelt Line.

The SILVERAY is 412 ft. in length overall, 57 ft. extreme breadth and 35 ft. 4 in. deep to the shelter deck. Her deadweight capacity is about 8000 tons. She is bigger than the three other Silver boats mentioned and has a bigger engine, the cylinder diameter being 22.83 in. as compared with 21.26 in. in the other vessels, with a stroke of 91.32 in. as compared with 85.04 in. in the other vessels. The engine is of the 3-cylinder type and develops about 2200 s.hp. at 90 r.p.m. In this enigne a spherical combustion chamber has been adopted, which is stated to give a better fuel economy and to facilitate the use of the heavier grades of boiler fuel. It is formed by the concave piston heads which, when close together at the beginning of the power stroke, shield the cylinder surface from the high temperature of combustion. The pistons are made of ingot steel, a material well suited to the high temperature at which they are desired to operate for the best fuel economy. This engine is reported to have shown a mechanical efficiency of 88 per cent at 2200 s.hp. and 88 r.p.m., the consumption of 14 deg. Beaumé oil being 0.4 lb. per s.hp. hour. On an Anglo Persian oil of about 27 deg. Beaumé this consumption was reported reduced to 0.37 lb. per s.hp. hour. The difference in consumption was mainly due to the difference in the heat value of the two fuels. All the auxiliaries in the engine room and on deck are electrically driven. For the electric service there are three 65 kw. generator sets.

The SILVERELM, SILVERFIR and SILVERCEDAR have been operating on just about the same schedules. Their route covers 27,000 miles from New York to the Far East and back. Their individual times have been $136\frac{1}{2}$ days, 138 days and 139 days.

Worthington double-acting engines will be the first sets installed under the Diesel conversion program of the United States Shipping Board. The two vessels have not yet been definitely chosen, but they will be selected from the SEMINOLE located in New York, and the TAMPA and UNICOI located at Norfolk. Progress on the engines has been so rapid that the Shipping Board will call for bids on the installation of this machinery about the time this issue of MOTORSHIP is published.

Lux fire extinguishing equipment has been fitted to a number of recently completed motorvessels, including the ESQUILINO of the Lloyd Triestino Line and the following tankers: DEN HAAG, PERSEPHONE, JOSIAH MACY, TRONTOLITE and S. V. HARKNESS. It has also been ordered for the EAST INDIAN of the Ford Motor Co., the GULF OF VENEZUELA of the Gulf Refining Co., the LIO of the General Petroleum Corp., the E. T. BEDFORD and J. A. MOFFETT, JR. of the Standard Oil of N. J., for practically all the motor tankers building for various American oil companies' affiliations abroad and for the U. S. Army motor dredges and a number of foreign owned ships.

Large Single-Screw Tanker

Another tankship with single-screw Diesel machinery of about 3000 s.hp. has been completed at the Jarrow shipyard of Palmers Shipbuilding & Iron Co., Ltd., for the British Tanker Co., Ltd., and is now in service. BRITISH CHEMIST, the new vessel, which carries a deadweight of about 10,000 tons on her loaded draft, is a duplicate of the BRITISH AVIATOR, also built at Jarrow. Both vessels are fitted with a Palmer engine, built under Cammellaird-Fullagar and Palmer patents, with six cylinders each 23 in. diameter by 35 in. stroke. The previous set constructed by the Palmer company, namely, that in the BRITISH AVIATOR, is working well in service, the fuel consumption for all purposes being $9\frac{1}{2}$ tons per day at a sea speed of 10 knots, with the vessel loaded to her full carrying capacity. The engine of the BRITISH CHEMIST was not run on the test floor, but after erection was taken down and installed directly on board. The only trial it had prior to the sea trial of the ship was a 4-hours' trial with the ship moored. The highest power developed was 3150 s.hp. at 90 r.p.m. There are two Diesel electric generating sets of 60 kw. each.

In the single screw motorship SKRAMSTAD which the Deutsche Werft recently delivered to A. F. Klaveness of Oslo and which is an open shelter deck vessel of 7950 tons d.w., the power of the A. E. G. engine is given as 2800 hp. This is of course a 4-cycle engine of the Burmeister & Wain type and delivers about 2100 s.hp. This size of B. & W. engine is generally rated at 1850 s.hp. The extra power in the case of the German engine is due to supercharging.

Jacksonville in South American Trade

Has Completed Maiden Voyage of 81 Days Under the Grace Flag with Only 44 Minutes Engine Trouble

THERE is perhaps less of uncertainty about the trade situation between the United States and South America than in any other quarter of the globe. Reactions of the war created flurries for a time, but, once they were over, business commenced to improve in a very satisfactory manner until at the present time cargo movements are not subject to great changes and are steadily increasing in volume.

This trade is open to the ships of all nations, and since American ships are handicapped to a certain extent with higher wage rates and capital costs than those of any other country it is becoming more and more necessary that they effect economies which will permit them to compete successfully.

Motorships promise to solve the problem. Evidence of this is presented in the performance of the m.s. JACKSONVILLE which has recently completed her maiden voyage under the Grace flag and given a very creditable account of herself.

Her southernmost port of call was Antofogasta, Chile, and she made 18 other stops, north and southbound, including the Canal Zone. She traveled 9447 miles and spent 81 days making the voyage. Her mode of travel was something like that of a theatrical troop making one night stands, neither going far nor at rest for long at one time. Her form of motive power seems to be admirably suited to this sort of work, because standby losses are practically eliminated.

A summary of the performance has been made from the engineer's log and is presented herewith:

Total distance	9447 sea miles
Total time on voyage	81 d.—1 h.—11 m.
Total time at sea	40 d.—5 h.—32 m.
Total time in Canal	16 h.—49 m.
Total time in port	40 d.—2 h.—50 m.
Average speed	9.78 knots
Average engine revolutions	101.75 r.p.m.
Total fuel for all purposes	2741 bbl.
Total fuel consumption at sea	2199 bbl.
Average daily consumption at sea	54.5 bbl.
Average daily consumption	7.27 tons
Fuel used in Canal	29 bbl.
Fuel for main engine in port, maneuvering and sanitary service, etc.	25 bbl.
Fuel for aux. engines in port, lighting, refrigeration and mooring ship	33 bbl.
Fuel for donkey boiler, cargo handling, anchoring	455 bbl.
Total cargo handled	9961.1 tons

Although reports of fuel consumption of the JACKSONVILLE as a steamship are not available, reliable information as to the performance of vessels of her class indicate that she would have used approximately 27 tons per day at sea and 7 tons per day in port, which would mean a saving of 6000 barrels for the entire voyage, almost 1700 barrels of which can be credited to port saving.

It then appears that a motorship in this trade, not necessarily the JACKSONVILLE, which is merely a fine example of conservative practice in steamship conversion, is capable of effecting economies, because a saving is made both coming and going, and while neither coming nor going.

She made an almost perfect maiden voyage, averaging 2150 i.hp. for the main propelling unit, which is rated at 1600 b.hp. at 110 r.p.m.

We said almost perfect. Her trip was marred by a stop of 44 minutes at sea while a sticking air starting valve was freed. This occurred just before she arrived at Puerto Colombia, the first port of call southbound. A. L. Foster, the Chief Engineer, stated that he did not feel it was safe to maneuver into the dock with the valve sticking, and he had to delay the docking by that length of time and could not avoid the "Engine Trouble" entry in the log, much as he had hoped to make a perfect maiden trip. We think Mr. Foster might well "laugh it off."

Although the JACKSONVILLE is operating under the Grace flag in the same service with her sister ship the ASHBEE, both of these vessels belong to the New York Shipbuilding Corporation, which purchased them from the Shipping Board with a view to demonstrating the performance of their Diesels, descriptions of which have been published in MOTORSHIP.

The Grace Line promises to become prominent in the operation of motorships. In addition to these two vessels they have the CITY OF SAN FRANCISCO and CITY OF PANAMA which are owned and operated by their subsidiary company, the Panama Mail S. S. Co., and the tug GRACE which is used about the dock in New York for general service.

To return to the performance of the JACKSONVILLE. When she arrived in New York she was practically light, having unloaded most of her cargo at Wilmington, N. C. Loading was started at once, and within five days she was on her way to South America again.

There was not a repair made in the engine room. During the voyage a porous spot in the head of the hydraulic pump of the steering gear leaked a small amount of oil which was something of an annoyance, and since no spare was carried this had to be replaced.

That constituted all of the work of a mechanical nature which was done, save the removal and survey of one piston. The cylinder wall was perfect, rings were all free and the piston was clean. It was replaced in the cylinder just as it came out.

One admirable feature of this West Coast of South American run, from the operating engineer's viewpoint, is the abundance of time available for him to do the routine work. It means that he comes into the home port with nothing on hand but stores and fuel to receive and such items of repair as cannot be taken care of at sea.

With the JACKSONVILLE'S well equipped little machine shop it is possible to do nearly everything needed, without having to send ashore for help. All of this tends to create a feeling of satisfaction among the engineers, and that in turn has much to do with the success of this vessel.

Aorangi's Fuel Consumption

THE motorship AORANGI arrived again in Vancouver, B. C., from Australia July 24. She has made an enviable record for herself, and has more than justified the confidence of her owners in Diesel engines. She has a clean record of operation.

It will be remembered that the AORANGI is engined with four Fairfield-Sulzer 2-cycle Diesel engines of 3250 s.hp. each, driving four screws. There is very little time available for checking over the engines in port. For instance, she arrived in Vancouver on July 24 and sailed for Australia on the 29. During the time in port it was necessary to shift berths under her own power. However, during the short stop in Vancouver one cylinder was opened for inspection, and no measureable wear of the cylinder liner could be found above the ports after a round trip of operation.

The following data were obtained from the engine room log:

Jan. 2, 1925, to July 24, 1925

Total distance	55,394 miles
Total running time	3,438 hours
Total running time	143.3 days
Mean ship speed	16.4 knots
Maximum ship speed	18.6 knots

TOTAL FUEL CONSUMPTION

Main engines	6,265 tons
Auxiliary engines and boilers	1,341 tons
All purposes	7,606 tons

AVERAGE DAILY CONSUMPTION

Main engines	43.6 tons
Auxiliary engines	9.4 tons
All purposes	53.0 tons

It thus appears that the main engines consume 82.3 per cent of the total fuel consumed, the auxiliary engines and boilers taking 17.7 per cent. Our correspondent does not explain whether the fuel consumption of the auxiliary engines and boilers in port is included in the above figures, and the two last figures of average daily consumptions should therefore, be regarded as capable of interpretation in two correspondingly different ways.

One of the new motorships for the service which Garcia & Diaz are operating between New York and South American ports was recently completed. She is the PRIMERO, designed to load about 7600 tons d.w. on a length of 367 ft., breadth of 53 ft. 6 in. and a depth of 27 ft. 6 in. The propelling machinery consists of two 6-cylinder Burmeister & Wain trunk-piston engines developing about 1700 s.hp. aggregate. All her deck machinery is electrically operated. The registered owners are the A/S Ivarans Rederi of Oslo. The stock of the company is held by American, Spanish and Norwegian firms.

Whaley Constant-Pressure Engine

Cylinder Pressures Limited to 350 lb. per sq. in. by Blowing Higher Pressures into a Receiver

LAST month announcements appeared in the Eastern newspapers that a party of stockholders and interested engineers had witnessed a private showing of the latest Whaley engine at the plant of the Sun S. S. & D. D. Co., Chester, Pa.

The announcements were premature and had not emanated from the Whaley firm, which was quite properly refraining from the publication of any statements until development reached a commercial stage. At the recent private demonstration the engine, which is the ninth of a series built during the last few years, was operated only on air, as a prelude to the shop tests.

In order to counteract the tendency that began to manifest itself in the press to exaggerate and distort the true efforts of the inventor, William R. Smith Whaley, a report on the new engine has been made by OIL ENGINE POWER, one of the Freeman-Palmer publications, from which we quote the following.

". . . It is said to be a single-acting four-cylinder two-cycle machine rated at 750 hp. and to be distinguished from the general run of oil engines in that the cylinder is kept floating on a pressure reservoir both by an overflow valve and by a piston valve as long as fuel is being injected and burnt. According to information received, the usual form of port scavenging is supplemented by high-pressure scavenging and after-charging, the pressure at which the two latter processes are carried out being around 45 lb. per sq. in. An air pump formed by a dished piston between the working piston and the crosshead is double-acting, and while it compresses air for normal scavenging purposes on its under side to about 5 lb., it delivers air for the so-called super-scavenging and after-charging at 45 lb. from its top side to valve ports on the combustion space.

"A link quite closely resembling that used on locomotive valve gears actuates the piston valve which was referred to above as establishing communication between the combustion space and the reservoir. By 'linking up,' the opening of the piston valve is made to correspond to the period of fuel injection in such a way that for practical purposes there is no combustion except while the piston valve is open. Minor departures from this scheme of operation are said to be taken care of by the spring loaded valve, through which air may also be discharged from the cylinder into the reservoir when there is a tendency in the former for the pressure to rise beyond 350 lb. per sq. in. As this is the compression pressure of the working cylinder it is also that of the reservoir, and normal running variations from it are expected to be negligible no matter what the conditions of loading and fuel injection may be.

"Merely floating the reservoir on the combustion space is said to require little actual transfer of air through the valves; at the same time it is hardly to be expected that enough fuel could be burnt within the limited confines of the combustion space to cause a substantial rise of pressure in the system. By an ingenious arrangement of piston valves the same combustion space port is made to serve successively for the introduction of the super-scavenging 'kick' and to establish communication with the reservoir during the combustion period. Arrangements on the piston valve stem actuate pumps to spray fuel by direct injection at 6000 lb. per sq. in. As it is recalled that the valve is linked up and that its travel is thereby altered, the possibility for maintaining the relation between the fuel injection process and the duration of valve opening to the reservoir is established.

"Stress is laid on the fact that practically no rise in pressure beyond that due to compression is expected. In practically all oil engines operating with a trapped air charge confined by a closed combustion space at least a 10 per cent rise in pressure due to combustion is essential to the attainment of economical running—not so much, probably, because of the extra force exerted on the piston as on account of the earlier timing of fuel injection and the progress of combustion at a higher temperature. In the Whaley engine even early timing would probably cause no substantial pressure rise up to the capacity of the transfer valves.

"Holding maximum pressures to a definite figure thus becomes the means of accurately carrying out a program for the design of a light-weight engine. As the factor of safety is more closely known when variations in maximum pressures liable to occur under service conditions are practically eliminated, both the framework and moving parts of the engine can be proportioned accordingly. It is claimed that the 750 hp. engine recently exhibited weighs only 68,000 lb. or about 90 lb. per hp., a figure which would represent a substantial improvement over current practice. For marine work such a reduction in weight would have obvious advantages, and as manufacturing costs are often found to be proportional to the weight of the engine produced, there is a considerable economic advantage to be gained also for land engines by the elimination of superfluous metal.

"Another feature which is said to aid in reducing weight per horsepower is the uniflow scavenging obtainable by allowing the 'kick' of high pressure air to pass through the combustion space and out through the ports. The valve through which this air enters is opened only a few degrees before the closing of the exhaust ports and remains open long enough after closure for the cylinder to be filled with air having a considerably higher density than that of the atmosphere. The horsepower rating of the engine would be directly increased by the extra weight of air present in the cylinders.

"As compression therefore begins with, say, 45 lb., a relatively small reduction in volume suffices to bring it up to 350 lb. corresponding to the temperature required for ignition. That means the combustion or clearance space may be larger and may lend itself more easily to a favorable location of the fuel spray and other valves than is the case with engines beginning to compress at substantially atmospheric pressure."

Whaley Engine Patents, Inc., owns the patents for the Western Hemisphere, and International Whaley Engine Corporation owns the patent rights for the Eastern Hemisphere. The American Locomotive Company has an exclusive license for the use of the Whaley engine on rails for the Western Hemisphere. The Sun Shipbuilding & Dry Dock Company, Chester, Pa., has a contract for building these engines for marine and stationary use in the United States. The engineering firm of Parish & Tewkesbury, Inc., New York, has had executive charge of this development since February, 1924.

Canada Motorship Subsidy Killed

A special committee of the Canadian Dominion Parliament reported that it was unable to endorse the plan of the Canadian Government to enter into the contract proposed with the British shipowner, Sir William Peterson, for a subsidy in aid of a North Atlantic line of motorships. The terms of the proposed contract were published in the April issue of MOTORSHIP. The decision of the committee was based upon political and economic considerations. So far as the type of ship itself was concerned, a recommendation was made that Sir William Peterson should be given an opportunity to substantiate the claims made by him in respect to his new corrugated ships under conditions that should ensure him fredom in obtaining cargoes. Sir William Peterson's untimely death in Canada, where he was waiting for the report of the committee, will probably prevent any further steps being taken along the lines projected. He was alone in his enterprise.

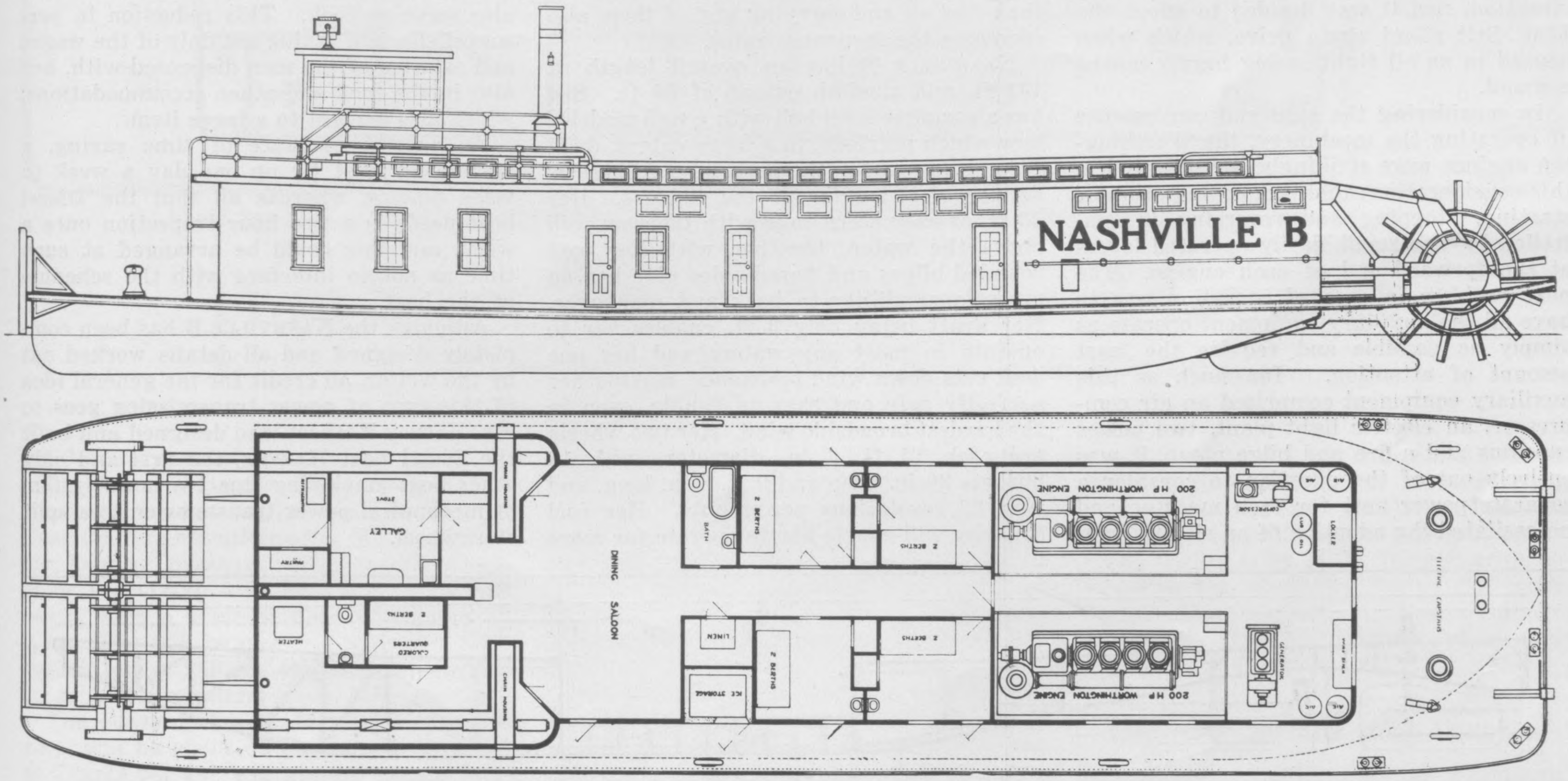
Coasting Ship for Siam

A combined cargo and passenger vessel of 235 ft. 6 in. overall length, 35 ft. 6 in. breadth, 20 ft. depth and 12 ft. 11 in. loaded draft has been completed for the Siam Steam Navigation Company of Bangkok, Siam. The vessel was built in Denmark by the Nakskov Shipyard and has been named the MALINI. She will be used in the coasting trade between Bangkok and Singapore. The vessel has two decks, and her passenger accommodation has been laid out with a view to satisfying the requirements of travel in the tropics. The machinery, which is of the Holeby Diesel type, consists of two engines developing 800 s.hp. aggregate. All the auxiliary machinery, steering gear, anchor windlass and cargo winches are electrically operated.

Sternwheel Diesel Towboat of 400 HP.

A Mississippi River Tug with Twin Engines, Silent Chain Drive to Jackshafts and Reduction Gears

By H. B. Dyer*



Elevation and general plan of the 400 hp. Diesel engined towboat with chain drive and reduction gears to twin sternwheels

NASHVILLE B is being built by the Nashville Bridge Co. at its own expense for the purpose of demonstrating the reliability, economy and efficiency of this type of shallow draft river towboat.

The primary consideration in the design was to obtain reliability coupled with the ability to back and flank a heavy tow, to maneuver and turn in close places and to operate in shallow water without the usual dangers encountered by propeller driven boats. The next consideration was to obtain a power plant and transmission which would give the longest possible life with the least amount of attention and upkeep. Other factors which have been given due consideration are the ease and convenience of operating the main engines and all auxiliary equipment, the comfort and safety of the crew and low insurance rates.

In order to obtain absolute reliability, it was essential to have two independently operated units, so that if for any reason it should be necessary to stop one engine the other can continue to operate and keep the boat under way. Another consideration under reliability was to use a Diesel engine, so that the paddle wheel could be turning at any time on two seconds notice.

To obtain a boat which would back and flank a heavy tow it was essential to use the stern paddle wheel, since no propeller will back as efficiently as a sternwheel. In addition to this, it was necessary to adopt direct reversing engines so that full 100 per cent power could be obtained in backing.

The superior maneuvering ability of the old independently operated sidewheel boats is an undisputed fact. The independently operated sternwheel system is not as efficient in maneuvering as the old side wheelers, but is a vast improvement over the ordinary type of sternwheel boat. This fact will be corroborated by Capt. Green and Capt. Bell, old style steamboat pilots and now pilots on the Diesel boat HARVEY.

Successful operation in shallow water and in water where submerged snags and rocks are numerous can never be obtained with anything but a paddle wheel boat, since it is impossible to use propellers in this kind of water without the constant fear of breaking a fluke. Then too, it is impossible to obtain the same efficiency with a propeller boat of this power, since to obtain sufficient thrust area, it is essential to use a large propeller, making it necessary to use the tunnel type of stern to obtain shallow draft which in turn causes a loss in efficiency of approximately 20 per cent.

In adopting a power plant which would give the longest life with the minimum amount of attention and upkeep expense, it was judged that a 2-cycle airless injection engine was much simpler and had fewer moving parts than any type of 4-cycle engine or any type of air injection engine. The next point to consider was to obtain an engine in which the crankcase lubrication is entirely separate and independent of the cylinder lubrication, so that all contaminated oil from the cylinders is kept out of the crankcase. Unless this is done the crankcase oil is soon contaminated, causing the oil strainers and pump to clog and making it necessary to drain and renew this oil at frequent intervals. Another consideration was to obtain an engine with a lubricating system which would keep all main bearings, crankpin bearings, wrist pins and crosshead guides constantly flooded with a stream of oil under pressure. This is the only method by which wear can be reduced to a minimum. It is also necessary that a high compression engine of this size have its pistons oil cooled. It was found that for the size of units wanted, the Worthington engines fulfilled all of the foregoing factors to the best advantage and in addition had several other points of merit which made them the most desirable engines for this type of installation.

In selecting the method of transmitting the power to the wheel, the main considerations were as follow: first, to adopt a transmission with a minimum possible weight; second, to have this transmission occupy as small an amount of interior cabin space as possible; third, to select a type which would operate with the least amount of attention; fourth, to select a type which would give the longest wear; fifth, to adopt one that would run as silently as possible; and lastly to have it so arranged that it would not be a source of danger to the crew.

In regard to weight, the mechanical transmission was adopted since it was far lighter than the electrical drive and in addition was considerably less expensive.

To avoid interference with cabin space any type of belt drive was eliminated and any type of shaft drive above deck was eliminated, making it necessary to adopt a

*Marine Engineer for the Nashville Bridge Co.

shaft drive with the shafting below the deck. In putting the shafting below the deck, it was especially important to adopt a type of bearing which would require practically no attention. For this reason all bearings on the shafts below deck are self-aligning ball-bearings housed in oil tight casings, which will require lubrication only once every three or four months and in addition will reduce the friction load of these shafts about 80 per cent. The interior jackshaft bearings, which are above deck and easily accessible, are standard self-aligning, ring oiling, babbitted bearings, while the exterior bearings at the gears are special cast steel, bronze-lined bearings encased in an oil tight casing and lubricated by the pressure oiling system which requires no attention except to keep a supply of oil in the case. The above mentioned bearings in addition to requiring the least amount of attention will also give long life, free from the usual bearing troubles.

In regard to silent operation of this transmission, any type of roller chain was eliminated on account of its excessive noise and vibration, and it was decided to adopt the Link Belt silent chain drive, which when housed in an oil tight casing hardly makes a sound.

In considering the ease and convenience of operating the machinery, the Worthington engines were strikingly well adapted to this consideration: their whole operation of starting, stopping and reversing is controlled by two small, easily operated levers at the forward end of each engine. The next problem in ease of operation was to have all the auxiliary equipment operate as simply as possible and require the least amount of attention. Inasmuch as this auxiliary equipment comprised an air compressor, an electric light plant, two power capstans and a fire and bilge pump, it was entirely out of the question to consider a separate power unit for each machine and necessitated the adoption of an electric generator set of sufficient capacity to supply current for the lights and to furnish sufficient electrical power for all of the auxiliaries. Another point in this connection was to have the generator set operate on the same fuel oil as the main engines. The generator set which combined the desired qualities and in addition required the least amount of floor space was found to be the well known Bull Dog oil engine which has been used on so many U. S. Government boats. With this type of installation, the generator can be started from stone cold and any of the auxiliaries put into operation within less than one minute. By the use of two electric capstans, a great amount of time can be saved in hitching up tows; for instance, a barge can be pulled up tight with the two capstans and the boat gotten under way, and the ratcheting up can be done later.

The fact that this boat carries only the one class of fuel makes the time and cost of fueling much less, and in addition makes the fire risk much less, since gasoline, kerosene or distillate are much more dangerous than fuel oil and carrying any of them also increases the insurance rates.

NASHVILLE B has an overall length of 131 ft. and a width overall of 30 ft. She has a complete steel hull with a well modeled bow which prevents, to a large extent, drift from going under the boat, where there is danger of it lodging in the rudders. Her 20 ft. of easy stern rake with transom well above the water, together with her well rounded bilges and flared sides give her an exceptional ability to back and maneuver. Her draft being only 3 ft. enables her to operate in most any waters and her one deck cuts down wind resistance, making her perfectly safe and easy to handle, even in the hardest broadside wind. Her two wheels are each 15 ft. 4 in. diameter, with 13 buckets 30 in. deep and 9 ft. 3 in. long, and turn 23 revolutions per minute. Her fuel capacity will enable her to operate for more than a month without stopping to refuel. Her cost completely equipped will be approximately $120,000.

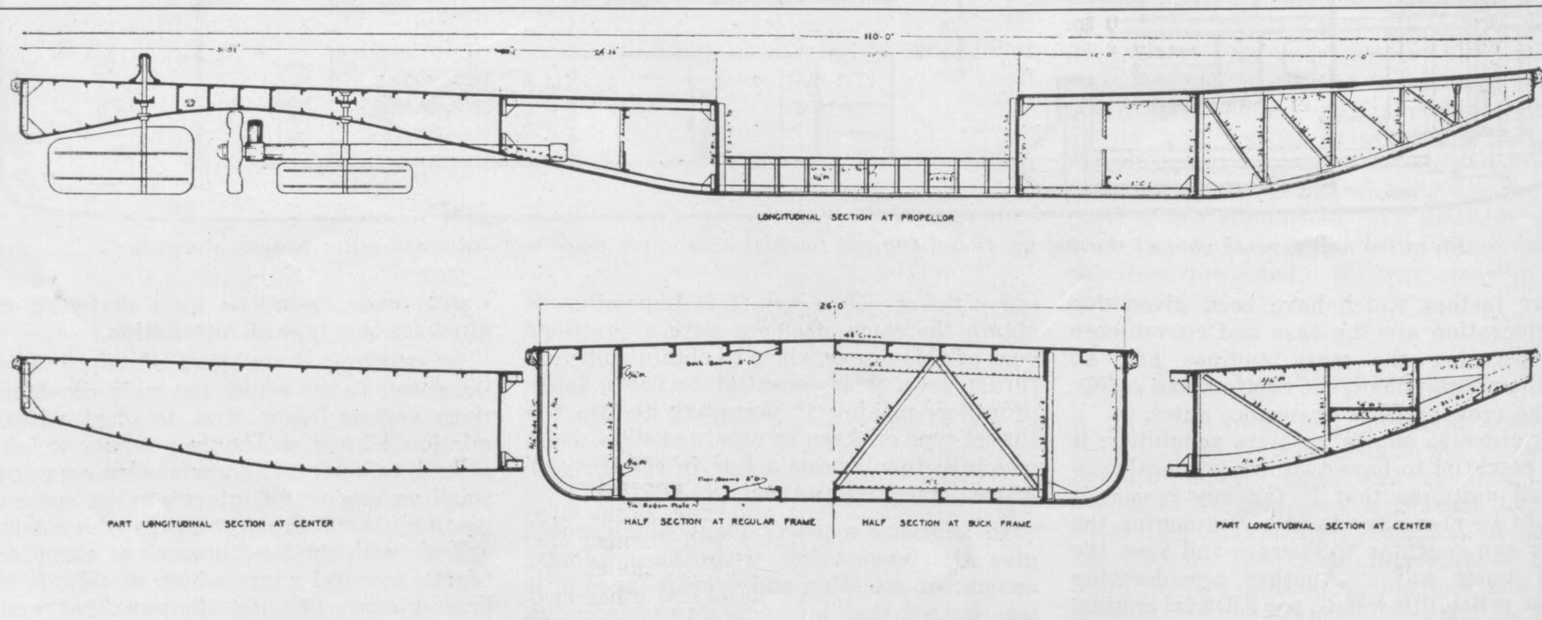
Although the cost of fuel on all boats is a large item, and the saving in fuel of the Diesel boat over the steamboat is one of its chief advantages, it is by no means the only advantage or the only saving which this type of boat effects over the steamboat.

For instance, during a period of a year the cost in time and money of simply putting coal aboard a steamboat amounts to a large item of expense. The Diesel boat can be fuelled in one-tenth of the time and at one-tenth the cost, effecting a saving not only of money but adding to the useful time the boat may be employed.

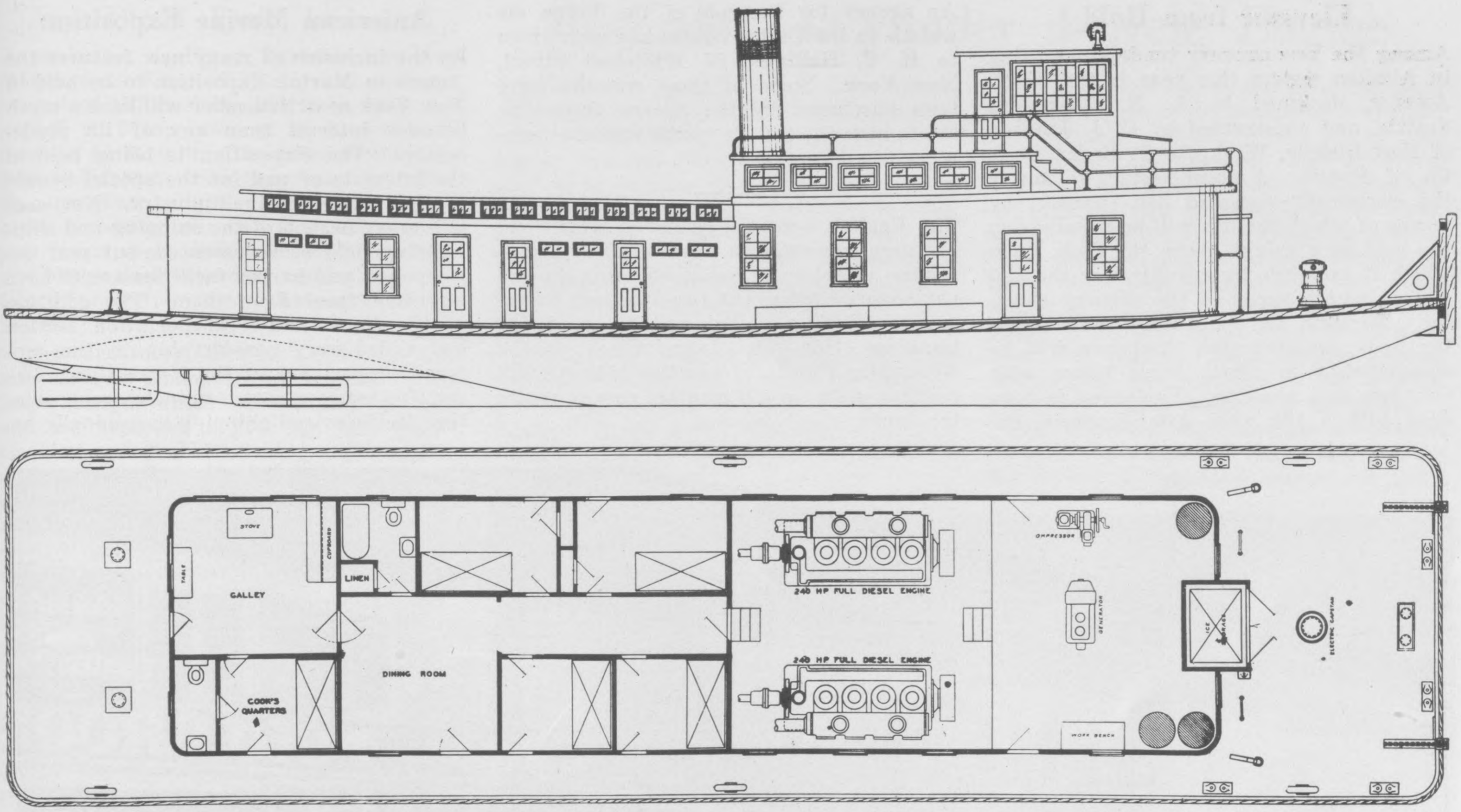
As another instance, the crew of a steamboat amounts to one of its large items of expense. A 400 hp. steamboat would probably have a captain, mate, pilot, engineer and assistant, two firemen, two roustabouts and a cook. The Diesel boat does not require licensed men and could be operated with pilot, engineer and deck hand. With such a small personnel, the deck hand could also serve as cook. This reduction in personnel effects a saving not only of the wages and salaries of the men dispensed with, but also in the food and other accommodations, which also amount to a large item.

As another instance of time saving, a steamboat must tie up one day a week to wash boilers, whereas all that the Diesel boat needs is a two hour inspection once a week, and this could be arranged at such time as not to interfere with the schedule of the boat.

Although the NASHVILLE B has been completely designed and all details worked out by the writer, all credit for the general idea of this type of power transmission goes to Mr. Harvey Herbert who designed and built the Diesel boat HARVEY, the first and only other boat employing this two unit system of mechanical power transmission to a split sternwheel.



Longitudinal and transverse sections of twin-screw tunnel stern river towboat North Star described in the article on opposite page



North Star, a logging towboat with tunnel stern, now building for the Dillman Egg Case Co., of Carruthersville, Mo.

Twin Screw Tunnel Stern Diesel Towboat

A 480 s.hp. Tug for River Use in the Logging Business of a Carruthersville, Mo., Firm

THIS boat, which will be called the NORTH STAR, is being built by the Nashville Bridge Co. for the Dillman Egg Case Co., of Carruthersville, Mo., for use in the logging business. The overall dimensions are 111 ft. 0 in. long and 27 ft. 0 in. beam, with a draft of approximately 4 ft. 0 in. She will be powered with two Fairbanks, Morse 240 hp. engines, turning 64-in. 4-blade propellers.

The consumption of fuel oil at full 480 s.hp. will be about 30 gal. per hour, which at 6 cents per gal. will amount to only $1.80 per hour, or $18.00 per 10 hr. day. The lubricating oil consumption will be approximately 2000 hp.-hrs. per gal. or about 2½ gal. per day, which at 50 cents per gal. amounts to only $1.25 per 10-hr. day.

This low fuel cost is only one of the places where this type of Diesel boat effects a saving over the steamboat. For instance, it can be operated with a pilot, engineer and deck hand, one of whom are required to be licensed, whereas a steamboat of the same power would require a personnel of at least twice this number. As another instance, this boat can be fuelled in one-tenth the time and at one-tenth the cost of putting coal aboard a steamboat, which during a year's time amounts to a large item.

In addition to the above mentioned savings, the Diesel boat will have at least 15 per cent more useful operating time, since a steamboat must be laid up one day each week for washing boilers.

The hull, of course, will be built completely of steel. The entire deck will be steel, and that portion outside of the cabin and in the engine room will be of checkered steel plate, to prevent slipping in wet weather. The seams in this plating will be made flush, thus eliminating all unsightly laps and joggles. Four extra heavy built-up plate girders extending from bulkhead to bulkhead will serve as the engine foundations and are so constructed as to practically eliminate all vibration.

The tunnels are so arranged that the 64-in. propellers do not extend below the base line of the hull and are designed to offer the least possible resistance to the flow of water.

Each propeller shaft aft of the stuffing box is carried in two Goodrich Cutless rubber bearings, which are water lubricated, thus eliminating all lubrication worries at this point. At these bearings the shafts are fitted with bronze sleeves, which together with the bearings are easily removed and replaced when worn.

In addition to the main engines there will be a 10 kw. Fairbanks, Morse generator set, which operates on the same fuel as the main engines. This generator will furnish current for the lights and also for the electric capstan, pumps, compressor and other electrical appliances. The boat will be equipped with a power steering gear operated by air and all other conveniences, including baths with hot and cold water and everything necessary to a completely equipped boat.

Since the boat was originally designed, we understand, there has been some question about adding extra length by putting in more frames just aft of the engine pit. This would not affect the general underwater design, but would probably help in keeping the boat on a course. So far as maneuvring handiness is concerned, the twin engines and large rudder surfaces ensure ready response to the pilot's orders.

The design is by H. B. Dyer, marine engineer of the Nashville Bridge Co., working in conjunction with Mr. Frank Dillman, the owner. The cost completely equipped will be about $105,000.

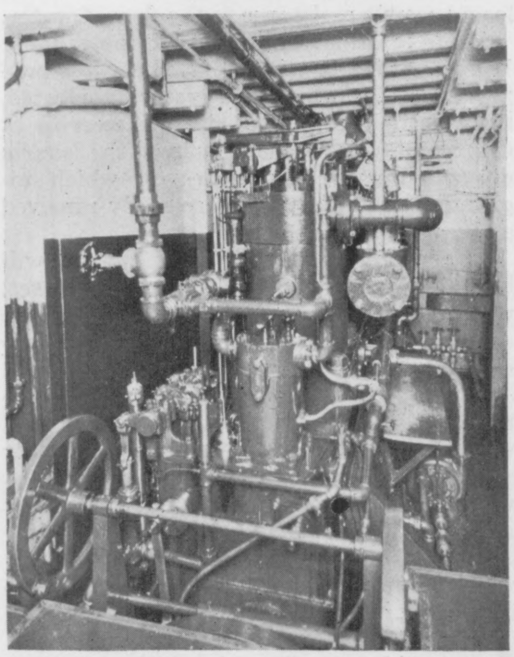
International Navigation Congress

The American section of the Permanent International Association of Navigation Congresses is taking steps to increase its membership in view of the wide and growing interest taken in this country in water transportation. The Association was organized some years ago to meet the world-wide demand for a coördination of navigation and terminal facilities and practices, and for the practical dissemination of information as to the policies of different nations in this regard. The government of the United States and 36 foreign governments are included in the membership. Every three years a congress is held in one of the principal countries, to which a group of official delegates is sent by each nation. The next congress is scheduled for Egypt in 1926. Annual dues are $4.00 a year for individuals and $20 for corporations. Application for membership or request for further information should be made to the secretary of the American Section, Major G. R. Young, Room 2711 Munitions Bldg., War Department, Washington, D. C.

Elevator from Hold

Among the new cannery tenders operating in Alaskan waters this year is the 86 ft. AMELIE, designed by L. E. Geary, of Seattle, and constructed by C. J. Johnson of Port Blakely, Wash. for P. E. Harris & Co. of Seattle. A novel feature in her is the electrically operated fish elevator, by means of which the fish will be raised from the hold to a height above the deck, from which it can slide by gravity over the rail and on to the apron of the cannery elevator. Through the operation of this elevator it is expected that discharge will be accomplished in about three hours with only two men working. The vessel is powered with a 165 s.hp. Atlas Imperial engine, turning a 55 in. by 46 in. Hyde propeller, which drives the boat at about 10 knots. An 8 hp. Atlas auxiliary Diesel operates the generator and provides current for the lighting and for the auxiliary machinery, all the pumps as well as the anchor windlass and the brailing winches being electrically operated. This is one of the smallest installations in which a centrifuge has been installed, the type selected being De Laval. The purifier occupies a floor space only 13 in. by 18 in.

Alaskan cannery tender Amelie which has an electric elevator for lifting fish from the hold



Amelie's 165 s.hp. engine

A new 107 ft. passenger ferryboat named the WEST VANCOUVER No. 6 and equipped with a 200 hp. Atlas Imperial engine was expected to be placed in service last month on the West Vancouver Municipal Ferry run.

A 63 ft. missionary cruiser for the Presbyterian Board of Missions is being built in Seattle for service in Alaska waters. Her station will be Juneau. A 60 hp. Washington-Estep engine will be installed, and the boat will have electric lighting and hot water heating.

An agency for the sale of the Tyfon air whistle in the United States has been given to H. C. Hallings, 27 Whitehall Street, New York. Some of these whistles have been purchased by the Sperry Gyroscope Co. to have the Sperry visible signal attachment fitted to them.

The English 4-masted schooner WESTWARD has been converted in Hamburg into a passenger vessel with accommodation for 85 passengers and has had two auxiliary Diesel engines installed. She will be used for cruising. Her first voyage will be to the Norwegian Fjords. Later this year she will possibly start on a 9 months' voyage round the world.

American Marine Exposition

By the inclusion of many new features the American Marine Exposition to be held in New York next November will have a much broader interest than any of its predecessors. The Exposition is being held in the interests of and for the special benefit of the entire marine industry. Not only will every branch of the shipping and shipbuilding field be represented, but port development and harbor facilities are to have attention focused on them. The addition of the Ports and Transportation section has added very considerably to the economic importance of the Exposition. The relation between port terminals, transportation facilities and shipping is gradually becoming more and more widely recognized.

As a measure of the success attending the efforts of the organization this year, mention may be made of the fact that five Diesel engine building companies have taken space. This magazine will also be represented, after not having participated in the series of exhibitions since the first one closed its doors.

Fifteen important marine societies embracing all the technical and non-technical personnel of the industry—owners, operators, builders, architects, engineers, equipment manufacturers and port authorities—will convene in New York during Marine Week. In addition to their individual meetings these societies will also hold a general group meeting, which will be the most representative ever held. One of the latest plans conceived by the organizers for promoting a nationwide interest in the Exposition is a ship model contest for the Boy Scouts and Sea Scouts of America. The models are to be at least 18 in. long and not over 40 in.; they must be submitted to the committee on or before Nov. 6.

New Diesel Yacht Launched

A yacht for J. Percy Bartram has been launched at Krupp's. She has a length overall of 157 ft. 0 in., length on waterline of 147 ft. 0 in., beam of 25 ft. 6 in. and draft of 11 ft. 0 in. The name of this new boat is CARITAS. She is a vessel with continuous sheer, slightly raking stem, moderate over-hang aft with elliptical counter, continuous steel deckhouse on main deck, and bridge deck extending right aft so as to afford protection the full length of the vessel.

The machinery, located amidships, consists of two Krupp Diesel engines of the latest design, which develop 350 hp. each and are expected to give the new boat a cruising speed of 12 knots. The engine room contains, in addition to the main engines, a very complete equipment of auxiliaries, including two 20 kw. Diesel driven electric generators and air compressors; one emergency air compressor, electric driven sanitary, salt and fresh water pumps, fire pump, fire and bilge pumps. 2-ton ice machine and an efficient forced ventilation system.

Sufficient fuel capacity is supplied for a cruising radius of 6000 miles. Water tank capacity, cold storage for meat and vegetables and storerooms are designed so that the owner can cruise off-shore for sixty days without being required to refuel or secure stores of any description. CARITAS, which is of Cox & Stevens design, is expected to arrive on this side of the Atlantic in the early fall.

Performance of Pacific Commerce

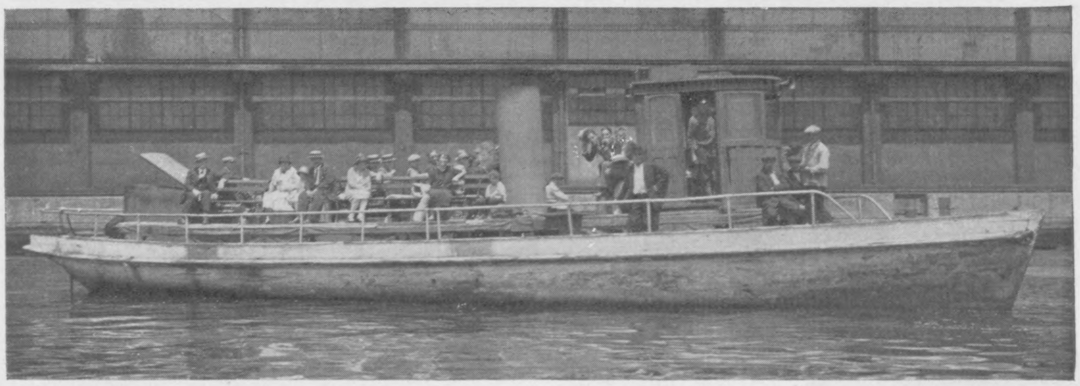
On her last passage from United Kingdom ports to the Pacific coast of North America, reaching Vancouver, B. C., in July, the Furness Withy Co.'s motorship PACIFIC COMMERCE made a 28 days' run from Manchester, England, to San Francisco in fine weather at an average speed of 11¾ knots on a draft of 19 ft., the 4-cylinder Doxford engine developing about 2800 i.hp. at 75 r.p.m. The fuel consumption was 10 tons a day for the main engines and 3½ tons for the steam auxiliaries. The only stop made was in passing through the Panama Canal, while locking, etc. Mr. Watkins, the chief engineer, states that the lubricating oil consumption averaged 8½ gal. a day for cylinder lubrication and 2 to 3 gal. for make-up of the oil circulation system to the bearings; also 3 gal. for steam auxiliaries. An extra heavy D. T. E. Vacuum oil was used for cylinder lubrication and heavy medium D. T. E. Vacuum oil for bearings.

The fuel oil used was a fabricated Diesel oil specially made up from California oil with certain lubricants and grading about 21 deg. Beaumé. This fuel was found more satisfactory than the ordinary grade of Diesel fuel, because the engines had been designed to burn a heavy oil and have been operated successfully on boiler oil passed through settling tanks. On her last passage the PACIFIC COMMERCE was fitted with Sharples' centrifuges for purifying the fuel oil. PACIFIC COMMERCE was formerly called DOMINION MILLER and has been in commission since 1921, making about 3 round trips a year, totalling 50,000 miles per annum. Her cargo capacity is 9500 tons.

Reversing 4-Cylinder 4-Cycle Engine

WITH the installation of a 90 hp. 4-cylinder Standard direct reversing engine in the REPOSO, Captain Eulo D. Baldwin of National Park, N. J., has found it possible to increase his operating time per week to over 100 hours. REPOSO runs week days between Gloucester, N. J., and the League Island Navy Yard, Philadelphia, and Saturday afternoons, Sundays and holidays between National Park, N. J., and Spruce St. Wharf, Philadelphia.

She is 65 ft. long, 12 ft. beam, 5 ft. draft and makes a speed of 13 miles per hour on a fuel consumption of 4 gal. of 24 degree Beaumé oil per hour. The engine turns a 3-blade propeller, 46 in. diameter and 46 in. pitch, at 365 r.p.m.



Reposo, a Philadelphia boat, with reversing 4-cylinder 4-cycle engine

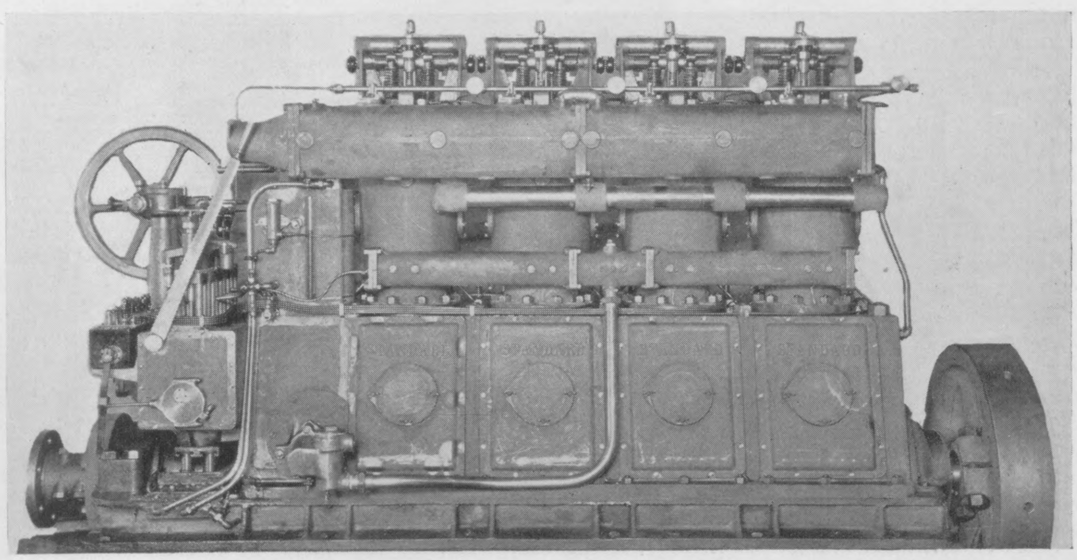
The accompanying illustration of the 4-cylinder 90 hp. reversing Standard engine installed in the REPOSO is interesting in that the Standard Motor Construction Co. is the first in this country to build a 3-cylinder or 4-cylinder reversing Diesel engine. It is being built under new patents held by them. The Standard Motor Construction Co. was the first to build a reversing internal combustion engine, this having been a gasoline engine built in 1902 from the design of the late C. C. Riotte.

For many years the industry has struggled under the limitation that neither 3-cylinder nor 4-cylinder engines of the 4-cycle type have been built in a reversible style, and the industry has been held down by the extra cost of putting in reverse gears on these sizes of engines, adding much to the first cost of installation. The Standard organization has led the way in this country in bringing about the reversing 3-cylinder and 4-cylinder engine. There are no dead centers in these engines. The wonderful ease with which the REPOSO is handled and operated in ferry service shows the satisfactory character of the reversing system. Capt. Baldwin has expressed himself as being more than pleased with it. As a matter of fact the reversing control is installed in the pilot house about 20 ft. away from the engine. This feature demonstrates that the reversing is not a trick, but a dependable mechanical operation.

For reversing and handling no greater air pressure is required than in the 6-cylinder reversing Standard engine. A great advantage of the 4-cylinder engine is the short space in which it can be placed because it eliminates the reverse gear which was half the length of the engine.

Rotor and Geared Motors

In the Flettner rotor vessel ordered by R. M. Sloman, Jr. of Hamburg, two Diesel engines of 1050 s.hp. aggregate will be installed. They will be of the 6-cylinder 4-cycle type turning at 300 r.p.m. connected with hydraulic reduction devices, which give a propeller speed of 80 r.p.m. The vessel will be built at the Weser Shipyard in Bremen and will have a deadweight capacity of 3000 tons, as reported in our June issue. The rotor tower will stand amidships and will be about 65 ft. in height and about 23 ft. 9 in. diameter, weighing about 38 tons.



New Standard 4-cycle 4-cylinder reversing engine installed in Reposo

Two 240 s.hp. Towboats for the Ohio

TWO more twin screw Diesel towboats are to be built for operation on the Ohio River. These boats, which will be named respectively KOSMORTAR and KING'S LANDING, are for the Kosmos Portland Cement Company, of Louisville, Ky. They will be exactly alike, and will have a length of 75 ft., beam 19 ft. and draft 4½ ft. The power plant consists of two 120 hp. Worthington 2-cycle, airless injection, direct reversing Diesel engines, turning 48 in. manganese bronze propellers.

The hulls will be constructed of steel, and one of the outstanding features is that the shell plating will be of copper bearing steel, which has been demonstrated to have corrosion resisting qualities far superior to the ordinary ship or tank steel. The walkways along the deck will be of checkered steel plate, a safety feature which the Nashville Bridge Company is putting on all their towboats.

The equipment will be complete in every way, including a Kohler automatic electric light plant, running water and washing facilities with showers, distilling apparatus for supplying drinking water, equipment for pumping out barges and many other conveniences to make them both comfortable and practicable.

The engines will set low in the hull on especially designed heavy built-up plate girders, which are framed into heavy transverse bulkheads, thus assuring absolute rigidity and absence from vibration. This provision for proper and adequate engine foundations is a point which has been largely overlooked on Diesel engine installations in the past and has been one of the chief causes for the condemnation of Diesel engines on river boats.

One of the main disadvantages of screw propelled boats, in the past, has arisen from the trouble experienced with the after shaft bearings. The Cutless rubber bearings manufactured by the B. F. Goodrich Rubber Co., which are being installed on these boats, will eliminate much of this worry, since they require no lubrication except water and are not effected by sand or grit.

The fuel consumption on these boats when delivering full 240 s. hp. amounts to about 16 gal. per hour, which at six cents per gal. amounts to only 96 cents per hour, or $9.60 per 10-hr. day. The lubricating oil consumption is 3000 s. hp.-hrs. per gal., which amounts to only 0.3 gal. per day or about 40 cents per 10-hr. day.

For the past three years, the Kosmos Portland Cement Company has been operating the KOSMOS a similar, but smaller, boat built by the Nashville Bridge Co., in 1922, and illustrated on p. 516 of the July number of MOTORSHIP. They found it so satisfactory and so economical that they have now placed an order with the same concern for the two boats described above. They will be completed in December of this year and will cost $60,000 each.

A passenger steamer, the NORWOOD, is being rebuilt by the Ballard Marine Railways of Seattle and converted into a 90 ft. towboat with a 200 hp. 6-cylinder Standard engine.

Stockyards Company's Motortug

A new wooden harbor tug from the design of Eads Johnson, M. E., Inc., has been placed in service by the Jersey City Stockyards Company, for whom it was designed. The hull, which is 86 ft. long overall, 75 ft. long on the waterline, 22 ft. beam and 9 ft. 9 in. depth was built by the Crowninshield Shipbuilding Co., Fall River, Mass. The main engine is a 6-cylinder 400 s.hp. airless injection engine furnished by the Ingersoll-Rand Co. All the machinery and tanks were installed by the W. & A. Fletcher Co., Hoboken, N. J. Auxiliary power is supplied by a Hill Diesel engine, direct connected to an auxiliary air compressor and also to a bilge and fire pump through clutches. This engine drives by belt a small generator giving electric light. An Ingersoll-Rand air motor for steering and two-hand operated fuel transfer pumps complete the machinery aboard. For heating, a house type Arcola hot water furnace has been installed. Simplicity and compactness are special features of the ROBERT C. BONHAM which make her an unusually able towboat. The super-structure has been reduced in length over usual tugboat practice. The stack remains a useful feature, housing the exhausts of the main engine and auxiliary as well as the smoke pipe from the galley range, and is a convenient support for the Strombos air whistle. On entering the engine room, one is impressed with the space around the main engine, tanks and auxiliaries. The piping is all overhead within convenient reach. A mechanical telegraph of Cory manufacture is fitted for signals between engine room and pilot house.

Jersey City Stockyards, Inc., have added this 400 s.hp. towboat to the rapidly growing motortug fleet of New York Harbor

Financial Notes

New York Shipbuilding Corporation

An option on the majority of the stock of the New York Shipbuilding Corporation has been given to the Wilder Electric Trusts, representatives in the U. S. of Brown Boveri & Co., of Baden, Switzerland, it has been announced by P. A. S. Franklin, chairman of the Board of the N. Y. S. B. Corp. The announcement was made on Aug. 21 and the option is good for 60 days. The terms call for the payment of $30 a share in cash and $15 a share in preferred stock of the American Brown Boveri Company. Minority stockholders will also receive $15 a share in preferred stock of the new company, regardless of whether they sell their N. Y. S. B. Corp. stock. In the statement issued by P. A. S. Franklin the future development of the Camden business is broadly indicated by the following remark: "With its production diversified through the addition of Brown Boveri & Co. lines, under their management, supported with the high standing they hold in the electrical manufacturing field, the outlook for the New York Shipbuilding Corporation would appear to be decidedly improved over that which is now possible with the activities of the corporation practically limited to shipbuilding alone."

Furness Withy and Co., Ltd.

A dividend of 5 per cent and bonus of 2½ per cent on the common stock was paid out of earnings by Furness Withy & Co., Ltd., for the year ended April 30, 1925. This company is continually adding motorships to its fleet. The last five ordered were entrusted to the Deutsche Werft, which quoted a price so far below all other competition that the Furness Withy directors could not in fairness to their stockholders place the contract elsewhere. Prices have been taken for more motor vessels, 17 British bids and 5 foreign bids having been received, but the business will not be placed yet, the directors having hopes that lower British prices may later be made, permitting the work to be given to British yards. Furness Withy & Co., Ltd., have a large or controlling interest in the Johnston Line, Houlder Line, British Empire Steam Nav. Co., Furness Houlder Argentine Lines, British and Argentine Steam Nav. Co., Gulf Line, Prince Line, Manchester Lines, Danube Nav. Co., Norfolk & N. American S. S. Co., Economic Insurance Co., etc. The capital consists of 150,000 preferred and 4,000,000 common, par value, $26,675,000. During its last fiscal year the company made a profit of $2,564,398 before depreciation, only slightly less than last year.

D. & W. Henderson & Co., Ltd.

All the common stock of this Scotch Shipbuilding Company is owned by Harland & Wolff. The capital consists of $1,455,000 preferred and $1,455,000 common. During the year ended April 30, 1925, the operating profit was less than $40,000 which did not cover the expenses of management, but dividends, interest and rents received kept the balance on the right side of the profit and loss account. A bonus of 20 per cent on the common was declared out of undivided profits of previous years.

Course on Diesel and Oil Engines

OWING to the success of the course of lectures given on this subject at the Polytechnic Institute of Brooklyn, N. Y., last winter, another course will be given this winter. The enrolment last year was exactly 150 students, including marine superintendents, superintending engineers, steam engineers and oil engine salesmen. The next course will consist of 20 lectures of 2 hours each, beginning Oct. 2 and continuing every Friday at 7:30 p. m.

To meet the needs of those who wish to train themselves for operating, building, or designing oil engines the lecture course is supplemented by class-room exercises and laboratory periods. Several varieties of oil engines are available in the laboratory for demonstration and testing. Students enrolling for this work will meet every Tuesday evening to attend laboratory periods alternating each week with oral discussion and written tests in the classroom.

Special emphasis will be laid on operation and maintenance, but since it is felt that a knowledge of how and why a given type of engine came into being is indispensable for a well-grounded operating knowledge, these matters will be treated in detail. The scientific and mathematical aspects of oil engine construction will be developed with a view to making the operator able to think for himself and will advance far enough to prepare those students who wish it for manufacturing and designing work. In any case it is planned to cover the subject in far greater detail than is necessary for passing the examinations for certificates to operate motor vessels under the Steamboat Inspection Service.

Direct and personal supervision over the conduct of the course is in the hands of Professor E. F. Church, Jr., head of the Department of Mechanical Engineering, while the lectures are prepared and delivered by J. Kuttner, Editor of OIL ENGINE POWER and associate Editor of MOTORSHIP. Professor W. J. Moore, in charge of the engineering laboratory work at the Polytechnic Institute, will personally conduct the laboratory exercises and demonstrations.

Since Mr. Kuttner has stood watch on American motorships, he is in a position to present these subjects from the point of view of the man who is entrusted with the duties and responsibilities of the operating engineer. He has also been in close contact with oil engine development here and abroad and knows what is being done.

Students may register any time after September 1. The fee for the lecture course alone is $25. For the class room and laboratory instruction in addition, including the certificate if earned, the total fee will be $55. Separate registrations for class room or laboratory alone will not be received. Certificates will be issued only to those who attend all three of the instruction groups, and who qualify by adequate attendance and proficiency.

Motorshipping Loses a Pioneer

Dan Broström, one of the earliest figures in motorshipping and one of its most ardent adherents, was killed in an auto accident on July 24th while driving home from the launching of the m.s. SKANELANDS. He was born in 1870 at Kristinehamn, Sweden, His father was Axel Broström, the founder of the present firm of Axel Broström & Son. After attending the Swedish schools, Dan Broström was sent to Germany and to England to learn the shipping business. His father had started with practically no resources and acquired his first small boat only by persistent effort. From that small beginning grew the firm of Axel Broström & Son, which today is the biggest shipping enterprise in Sweden, and which takes an important rank in the world's shipping. The old man was a pioneer in the Swedish ore trade, and it was one of his boats, the UPLAND, which took the first cargo of Swedish ore out of Narvik, Norway, in 1903 after the completion of the rail connection to that Arctic port from the Swedish mines in Lapland. This is interesting in view of the completion this year of the two 21,000 tons ore carriers which Dan Broström built for charter to the Bethlehem Steel Corp. for a term of 20 years. Dan Broström became his father's partner in 1898. Until 1906 the business was mostly in the Baltic trade, but in that year Dan Broström started the A. B. Svenska Ostasiatiska, his first venture in a shipping line. Five years later the Svenska Amerika Mexico Linie and the Sverige-Levanten Linie were started under his direction. In 1914 he took over the management of the Swedish American Line which had just then been organized, and he controlled all these businesses up to the time of his death, in addition to the business that was still continued under the name of Axel Broström & Son. He was chairman of the two biggest shipbuilding companies in Sweden, namely the Götaverken and the Eriksberg Mek. Verks. A/B, and of the salvage and towing company known as the Göteborgs Bogserings och Bergnings A/B and also of the Svenska Lloyd, a combination of smaller Swedish companies operating in the North Sea and Mediterranean, and of which the old Svenska Lloyd Company itself was the core. He was chairman of the Swedish Shipbuilders' Association and of the Göta Canal. From 1914-17, he served as Minister of Marine in the Swedish Cabinet.

Last month the Shipping Board accepted the Ford Motor Company's offer for 200 laid-up ships. These consist chiefly of Lake type ships ranging between 3500 tons and 4150 tons d.w., but about one-fourth of them are bigger boats with a capacity of about 5300 tons d.w.c. Most of the vessels are laid-up in the James River, where there are 110; at Philadelphia there are 21; in the Hudson River there are 40; and 29 are at Gulf points. A period of 18 months is given to the purchaser to dispose of the fleet either by scrapping or reconditioning.

A license to manufacture Polar Diesel engines has been taken out by the Yokohama Dock Co., Ltd., of Yokohama, Japan, which now has in course of manufacture four engines of that type of 220 b.hp. each.

MOTORSHIP

Trade Mark Registered
Founded 1916

Published monthly at 27 Pearl Street, New York

MOTORSHIP
is a member of the
FREEMAN-PALMER PUBLICATIONS
MILLER FREEMAN.................RUSSELL PALMER

Thos. Orchard Lisle........................Editor
Russell Palmer ....Manager

Offices of MOTORSHIP
NEW YORK ....27 Pearl Street
Editorial, Advertising and Subscriptions
Cable address—Motorship, New York
Telephone: Bowling Green 3420

SAN FRANCISCO.............417 Montgomery Street
Telephone: Douglas 6974

SEATTLE ....71 Columbia Street
Telephone: Elliott 4715

ANNUAL SUBSCRIPTION RATES
Domestic $3.00
Mexico 3.00
Canada 3.50
Other countries (Postal Union)............... 3.50
Single copies: United States, 25 cents; other countries, 35 cents

MOTORSHIP is published on the 20th of the month prior to the title month of issue, and all changes and any copy for advertising must be received by the publisher not later than the 5th of the month, if proofs of the copy are desired. Notice of discontinuance of advertising must be given 30 days in advance of publication of the magazine.

Readers are invited by the Editor to submit articles, photographs or drawings relating to motorships, marine oil-engines or auxiliaries. Contributions used in the magazine are paid for on the 15th of the title month of issue, and other contributions are returned as promptly as possible.

American Petroleum Supply and Demand

A COMMITTEE of eleven of the directors of the American Petroleum Institute recently completed a study of the nation's future supply of petroleum.

As all readers of MOTORSHIP know, a survey of the nation's oil reserves was made in 1921 by the U. S. Geological Survey in cöoperation with the American Association of Petroleum Geologists. The estimate then made gave this country a reserve of about 9,000,000,000 bbls. of oil, which, at the prevailing rate of increase in consumption, would be exhausted in less than 20 years. It was this threat of entire depletion of the country's oil resources that led to the appointment of the Federal Oil Conservation Board by President Coolidge.

The American Petroleum Institute's committee does not disprove that threat by opposing figures, but stresses the fact that the greatest of the national petroleum reserves consists of the more than 1,100,000,000 acres of unexplored and unproven land underlaid with sedimentary rocks that await the drill, and vast quantities of oil may be expected therefrom. The contention may be made that this vast acreage is not a reserve and that it may be barren. The geological conditions, however, tend to controvert such an argument. It is useful to reflect over the meaning of the chart which the report includes, showing the record of past estimates compared with cumulative production in the ensuing years. The chart shows that with the progress of the years the estimates of reserves have increased, and cumulative production has kept pace therewith. This does not show that the more oil that is taken out of the ground the larger the reserves become, but it does emphasize that with each passing year our knowledge of the reserves is increasing, and we are well justified in believing that there is an enormous quantity of oil still to be taken out, of which we as yet know nothing.

Passenger Motorvessels for Coastwise Traffic

SHIPPING companies engaged in the coastwire passenger trade have a lesson to learn from the commissioning of the m.s. PARKESTON in the North Sea passenger service between Denmark and England. The lesson applies to passenger traffic on the coasts of the United States as well as over the rest of the world. It is a lesson so simple that its very simplicity presents the peril that it may be ignored. From the invasion of the short run passenger service by the m.s. PARKESTON in the coal-bound, ash-strewn North Sea the lesson is clear that steam tonnage in this class of trade is to become as quickly obsolescent as steam tonnage in the other trades the motorship has invaded.

This is not the first short run passenger motorvessel in service, but she is the biggest, and her foreign port of call is almost as close to the coal mines as Los Angeles is to the oil fields. She has struck further into coal country than she would do if she were running to Norfolk, Va. At Harwich, England, she could buy coal at about one quarter the price she must pay for her oil. This should shake the faith of the old-style shipowners who are still worshipping the false gods of cheap coal and short runs.

If the PARKESTON were the venture of a new corporation there might be room for an argument that the owners had allowed their enthusiasm for progress to run ahead of their knowledge of the shipping business. Actually the enterprise has sprung from old shipping stock. The owners have been in the Esjberg-Harwich business for more than 50 years, and they have a fleet exceeding 200,000 gross tons, which they operate to all parts of the world. The unkindest cut of all is that they are not even rich, having suffered very severe losses a few years ago in the crash of a big agricultural bank, the failure of which shook Denmark.

Whichever way one turns for possible reasons to minimize the significance of the PARKESTON'S entry into the North Sea passenger service the way is barred. The fact stands out predominantly and clearly that she was built for this trade because her owners, after a long and thorough analysis of the operating conditions on this run, done in the painstakingly careful and conservative manner of the Danes, concluded that the motorship would be a better earner and safer investment than the steamer. We heard a long time ago of the careful investigation that was made.

How can the motorship be superior, is the question asked. She will cost more, cannot reduce the fuel bill much, will not have any greater cargo capacity because the difference in the bunker space and weight is so small on short runs, the steamship man says. Where is the gain? If the answer is desired it can be found by a competent and impartial comparison between the steamer and the motorship. If on the other hand the question is asked merely because of disbelief and in the firm determination to continue disbelieving the answer will never be found. The motorship is superior just so far as the owner makes it superior.

If one takes the drawings and performance of a short-run passenger steamer and substitutes long-stroke, slow-speed Diesel engines for the steam machinery in order to make a comparison one will never get near the truth. Start instead with the cargo capacity and passenger space desired and take the higher speed Diesel engines, then one will find that the motorship requires a smaller hull and less powerful machinery to earn the same money as the steamer, and the capital cost of the motorship will not be exaggerated. The motorship will make more voyages in the year, because she does not have boilers to be cleaned—passenger steamers on short runs have to be laid off several times a year for this purpose. That is very important because her gross earnings will be accordingly greater.

These two considerations are so often overlooked by those who have their money in steam. Yet the first elements in any comparison between old type machinery and new are, first, the relative prices for equipment of equal capacity, and second, the relative gross earnings. If those are not correctly established the computation of net earnings is impossible.

When all the figuring is done there still remains the appraisal of the advantages of the motorship that cannot be measured in money, but have a monetary value. Because a motorship is a more modern unit than a steamer—even though the latter be only just through her trials—she has a greater advertising value for her owners and attracts more business. Obsolescence is a stranger to her, but hovers today over all steamers. Her hull depreciation is lower than that of a steamship and her machinery depreciation—so far as we can judge from the SELANDIA and other early vessels—will also be less.

These are some of the generally overlooked factors that are carrying the motorship into ever wider and wider service and restricting the future of the steamship to narrower and narrower zones. These are the factors that are going to disturb that last stronghold of the steamer, the short-run passenger trade.

American Deck Boys on American Ships

NOTHING can be more important to the American Merchant Marine than the upbuilding of a real 100 per cent American personnel and if American boys can be induced to go to sea and to stay at sea to become real seamen, there will be no need to worry about the wages paid. Two years ago the Sea Service Bureau of the Shipping Board adopted a policy of encouraging American boys to ship as deck boys on American vessels. The total number of boys placed during the last fiscal year was 1425. Over half of them had their reports on conduct and ability marked "very good." A large number qualified for the position of ordinary seaman. Eleven were transferred to the engine department, eight to the stewards' department and there were only 25 desertions. The American Steamship Owners' Association is reported to be considering the adoption of a similar plan for vessels of its members.

Another Motoryacht Building on West Coast

New 116-ft. Boat for Captain Griffiths of Seattle Has Been Designed for Long Ocean Cruises

CAPTAIN GRIFFITHS of Seattle, former Commodore of the Seattle Yacht Club and former Commodore of the Pacific International Yachting Association, is having a new Diesel engined yacht built for him by the Winslow Marine Railway at Eagle Harbor, Wash.

Captain Griffiths has built and owned a number of interesting boats, each succeeding one larger than its predecessor. The last one, the SUEJA was an 86-footer. His new boat the SUEJA II, will be 116 ft. overall length.

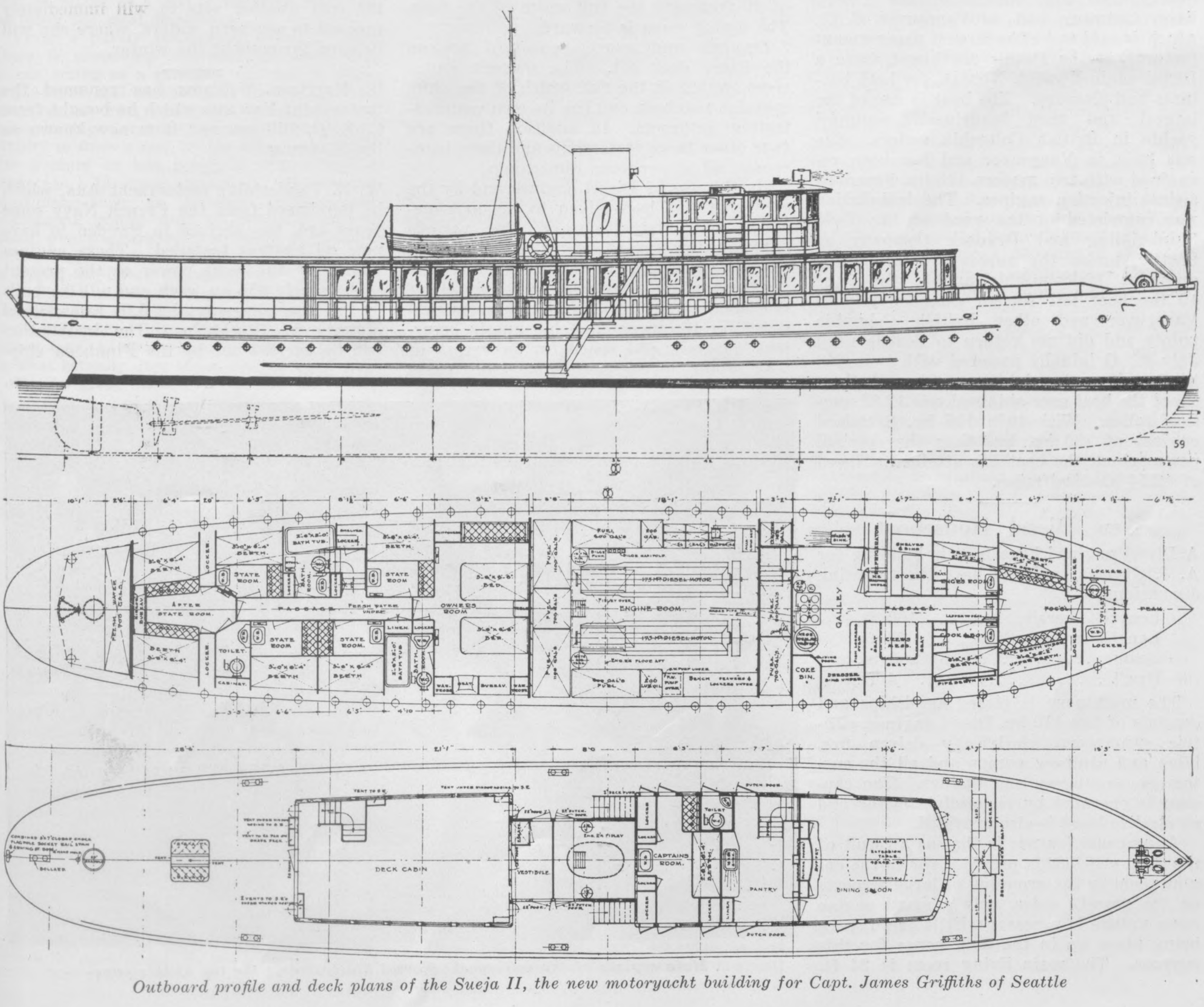
In his last boat, the SUEJA, Capt. James Griffiths cruised nearly 50,000 miles in five years, a record that cannot have been equalled by many, if any, American yachts. It can be understood, therefore, that the SUEJA II will be of more than usually heavy construction for a yacht. Her owner contemplates making long trips in her into northern and southern waters.

Oriental hard woods are being used for the hull. The keel, keelsons, frames and all longitudinal members will be of yacal, a Chinese wood. Below the water line the hull will be planked in the same way, but the topsides and deck will be of teak. The frames and joiner work were prepared in China and shipped to Seattle.

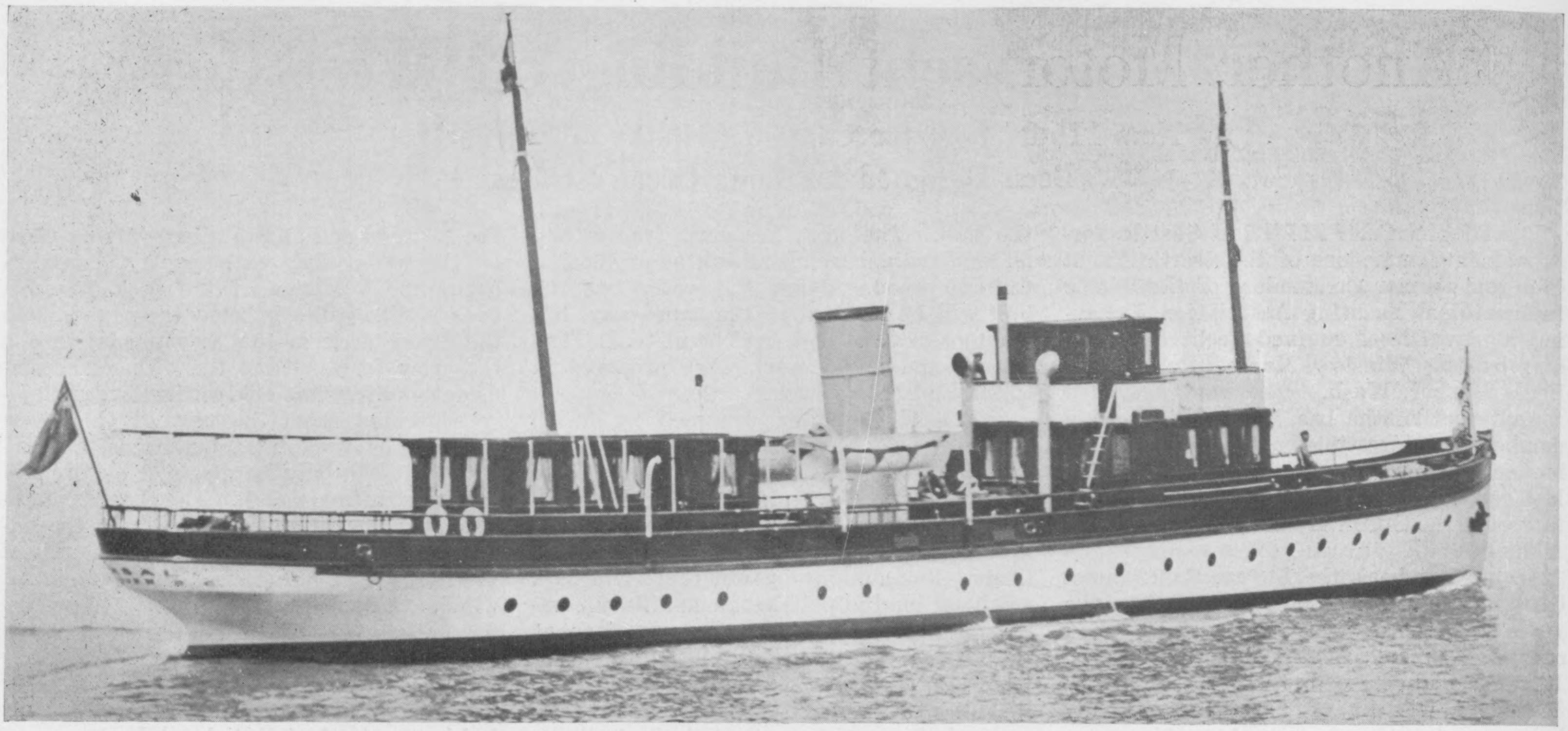
SUEJA II has been designed by L. E. Geary of Seattle, is 116 ft. long overall, 19 ft. beam and 7 ft. 6 in. draft, and will be driven by two 6-cylinder 180 hp. Washington-Estep airless injection engines which are expected to drive her at a speed of 11½ knots. For auxiliary power there will be a small oil engine driving an auxiliary compressor and auxiliary generator. Each of the main engines will drive a main generator while the boat is under way. All auxiliaries will be electrically driven. A feature of the machinery installation will be the pilot house control.

As shown by the illustrations, the main deck is given over to the dining room at the forward end and to a large living room at the after end, with pantry, captain's cabin and vestibule of the deckhouse between. The galley is below the pantry. On the lower deck is the accommodation for the crew forward and the owner's accommodation aft. The engineroom is completely separated from the rest of the lower quarters by watertight bulkheads, and access to it can only be attained by the ladder from the main deck. The owner's stateroom, which is immediately abaft the engineroom, has been sound-proofed. There are five guest's staterooms, the after one of which is a double room.

A twin screw motoryacht of about 550 tons British yacht measurement was recently launched by Ramage & Ferguson Ltd. at Leith, Scotland, for Richard F. Howe, of Long Island. The propelling machinery will consist of two Polar Diesel engines built in Stockholm.



Outboard profile and deck plans of the Sueja II, the new motoryacht building for Capt. James Griffiths of Seattle



A British Columbia motorcycle used by the stockholders and officers of a paper manufacturing company on the Powell River

Motor Yacht Norsal

Stockholders and officers of the Powell River Company, Ltd., of Vancouver, B. C., which is said to be the largest paper manufacturer in the Pacific northwest, have a Diesel engined yacht, NORSAL, for both business and pleasure. The boat is one of the largest and most luxuriously equipped yachts in British Columbia waters. She was built in Vancouver and has been re-engined with two modern 135 hp. Standard airless injection engines. The installation was completed at the yard of the Todd Shipbuilding and Drydock Company of Seattle, under the supervision of naval architect Malcolm McNaught. On June 10 the boat left for an extended trip to Vancouver and other British Columbia points and did not return to Seattle until July 8. Originally powered with twin 200 hp. 2-cycle surface ignition engines the best speed the boat ever obtained was 12.83 nautical miles. With twin 135 hp. Standard engines of 130 hp. less than the original power plant, the boat has attained a speed of 12.54 nautical miles.

New Diesel Houseboat

A Diesel engined houseboat is building for A. J. Grymes, and will have the following dimensions—

Length overall	100 ft.
Length on water line	98 ft.
Beam	18 ft. 6 in.
Draft	4 ft.

The machinery is placed amidships and consists of two 110 hp. Diesel engines, electric generators, electrically driven fire, bilge and sanitary pumps and all the customary auxiliaries and fittings. The capstan is operated by an electric motor and an electric hoist is also provided.

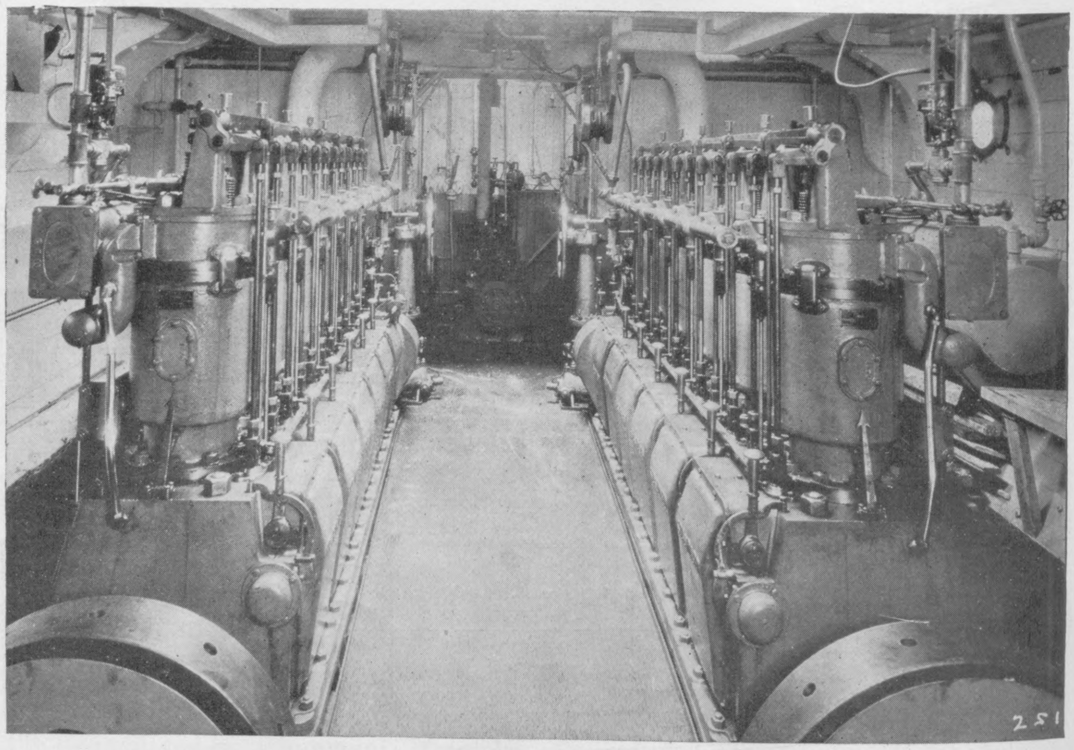
An unusual feature is that as a result of the good ventilation provided for in the engine room by the grouping of large airports on the vessel's sides, only a small engine room uptake is necessary, little or no space being given up in the deck house for this purpose. The main living room is 24 ft. in length and opens out to the after deck, where the owner has an uninterrupted space of 25 ft. length the full width of the boat. The dining room is forward.

Owner's and guests' quarters are on the lower deck aft. The owner's stateroom, which is the full width of the ship, contains two beds and has its own communicating bathroom. In addition there are four other large staterooms and three bathrooms, all of generous dimensions.

By the use of Diesel engines and by the care that has been given to the arrangement and disposition of the various quarters, the cost of operation will be extremely small and the number of the crew far below what is found in many vessels of the same type. In addition, there is provided for the owner and his guests luxurious quarters and space far in excess of what would have been possible a few years ago in such a boat. This new craft will be in commission early in the fall, and when the cold weather sets in will immediately proceed to southern waters, where she will be used throughout the winter.

G. Harrison Williams has renamed the motoryacht VANADIS which he bought from C. K. G. Billings and it is now known as the WARRIOR.

W. K. Vanderbilt's motoryacht ARA, which he purchased from the French Navy some years ago, has arrived in Sweden to have new oil engines installed. These engines will be of the same power as the present sets, namely 850 hp. each and will be built by the same company, the A/B Atlas Diesel Motorer of Stockholm. The installation will be carried out by the Finnboda shipyard near Stockholm.



Main engines of the motoryacht Norsal illustrated at the top of this page

Sketches and Working of Oil Engines*

Piston Rings and How They Form a Partial Seal While Acting Also as a Labyrinth Packing

As the first member of the mechanical train which gathers up energy from the gases and translates it into useful mechanical work on the crankshaft of an engine, the piston deserves special consideration. It is the movable wall of the combustion space, the fixed limits of which are the cylinder liner and head, and it is subject to the same combination of heat and mechanical stress.

Above all the piston must be capable of forming a movable seal against the pressure of the gases. Piston leakage in a steam engine causes merely loss of power and efficiency; in an oil engine it causes cumulative damage to the mechanism as well. Once "blowing" starts in the latter type of machine, it impairs lubrication and thereby encourages the rings to stick fast in their grooves, with the result that the blowing gets worse. Compression is lowered and with it the degree of excellence of the combustion; after-burning, overheating, fouling and a general impairment of operation, attended possibly by serious damage to the engine, are apt to be the consequences attendant upon leaky pistons.

Of all the functions performed by the piston, that of acting as a seal is therefore regarded as being the most important.

From a purely mechanical point of view there is something irreconcilable about the piston acting as a movable wall and forming a gas-tight seal at the same time. Freedom to move, as every mechanic knows, depends upon having a certain amount of clearance. Ability to form a seal, on the other hand, calls for a more or less complete elimination of clearance. In some classes of low-pressure machines, such as blowing engines and scavenging pumps used on two-cycle oil engines, piston clearance is so small in relation to the large volume of air handled that it has a negligible effect on operation. Strangely enough, the pistons or plungers used on high-pressure fuel oil pumps can also be made to work properly in plain lapped bushes; in the latter case, however, the viscosity of the oil is what actually does the sealing.

On the great majority of pistons met with in ordinary practice a special device—the piston ring—is used for the purpose of rendering negligible the leakage which would otherwise come through the mechanical clearance.

In a general way piston rings and their method of application are familiar to everyone who knows motors.

Rings are flexible and can accommodate themselves to the cylinder bore in response to their own mechanical "spring" and to gas pressure. Like the piston they too must have clearance on their flat sides in order to be mechanically free to move in their grooves. Clearance is also provided between the inside of the ring and the bottom of the piston groove, otherwise the ring would form an unyielding block between the cylinder wall and the piston and would quickly cause the latter to seize. End clearance at the butts of the ring must be allowed to prevent the ring from forming a continuous solid arch as it expands in response to heat, because such an arch is also liable to grip the cylinder. A clearer idea about these three clearances will come from a study of how a piston acts; they will then be discussed again, along with suggestions for the amounts to be allowed and for methods of fitting in place.

*Summary of a course of instruction at the Polytechnic Institute, Brooklyn, N. Y., by Julius Kuttner, B. Sc., Licensed Chief Engineer, Eidtor of OIL ENGINE POWER. This is the eighth chapter, the first one having appeared in the January, 1925, issue.

Knowing that a piston ring has clearance all around it, many may have been puzzled as to why it possesses any sealing properties at all; it would appear at first thought that the gases would simply blow through the clearances.

All sealing agents, be they ground mechanical joints, gaskets, or stuffing boxes, require mechanical force to be exerted on the surfaces between which the flow of gases is to be prevented; valves have springs and gas pressure,

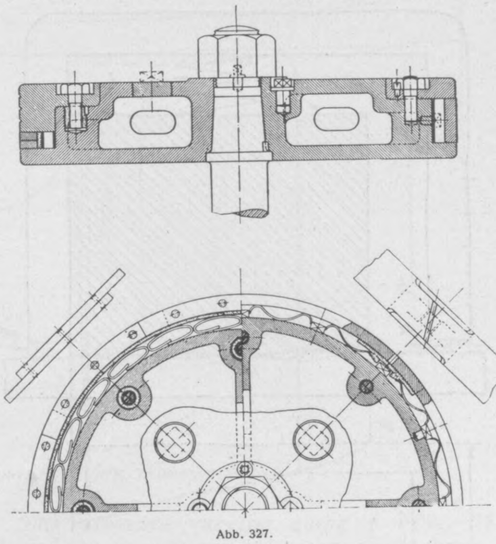


Abb. 327.

Fig. 74. Steam engine piston

gaskets are squeezed by means of bolts or studs, and stuffing boxes have glands and gland nuts. Piston rings are urged against the cylinder bore by means of their own elasticity, by separate springs, by gas pressure, or by a combination of two or more of these agencies. Labyrinth packings constitute an important exception to the force principle

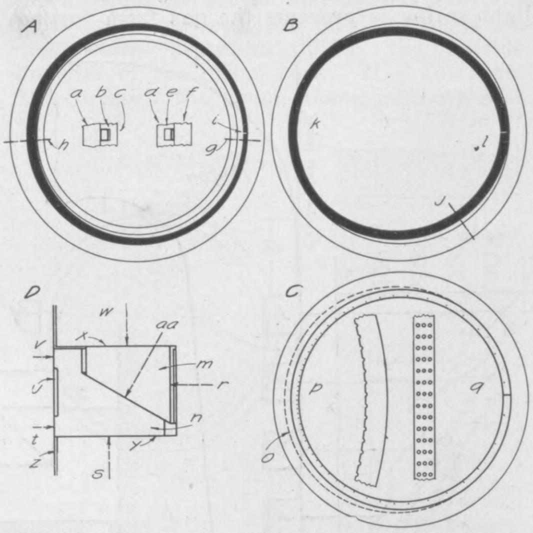


Fig. 75. Eccentric and hammered piston rings

underlying most sealing agents. They do not positively stop the flow of the gases, but they give them so much resistance that for practical purposes a seal is effected. Strange as it may seem, the labyrinth principle is an important factor in the proper action of piston rings; at any rate it does not seem possible to form a rational mental picture of piston ring action without calling on the labyrinth for help.

Steam engine piston rings are often backed up with individual springs spaced at frequent intervals around the circumference, and adapted to give highly uniform bearing pressures against the cylinder wall. However, as an inspection of Fig. 74 will show, such an arrangement is too complicated and contains too great a number of delicate parts to function with complete success in an oil engine. A well-designed, correctly operated machine of the latter type is sufficiently free from combustion residues to allow an ordinary one-piece ring to work well; but even the small amount of carbon and gummy substances which it normally produces would probably suffice for quickly putting out of action any such device as that shown in Fig. 74. The higher temperatures encountered in an oil engine cylinder would also make it unlikely that the tempered steel springs would permanently maintain their tension. There is nothing like cast iron for maintaining its elasticity and other desirable mechanical properties in the face of high temperatures, a view which is supported by the practically complete predominance one-piece cast iron rings have attained in the oil engine field.

That uniformity of bearing pressure attained in steam engine work by the use of individual steel springs is approximated for one-piece, cast iron rings by various methods.

A home-made ring is generally cut from an over-size "pot" to a diameter which will prevent the ring from entering the cylinder before a certain length of its circumference has been cut out. The ring may then be squeezed together until it is capable of entering, but its true circular shape would thereby be destroyed and it would make contact with the cylinder at only a few points. To avoid this the ring is squeezed together and held in that condition by a special fixture while it is turned or ground to the exact diameter of the bore in which it is to work, the necessary machining allowance having of course been provided on the diameter.

As thus partially corrected, a ring will have a true bearing all over the cylinder, but the pressure which it exerts will be far from uniform. An attempt has been made to illustrate this condition by means of B, Fig. 75, although it is to be noted at the outset that the diagram is incorrect on account of the large gap shown at j. However, the figure corresponds to evidence obtained from worm cylinder liners in which uncorrected rings were used: the ring bears hard and tends to cut near its ends l while it does the same thing at a point k directly opposite. Leakage is generally apparent at the location indicated by j, and the tips at l have been known to wear down to knife edges. In other words, the ring behaves as though it actually had the shape shown in Fig. 75 B.

One way of approximating uniform bearing pressure a little more closely is illustrated in Fig. 75 A, where a ring with an eccentric inner circle is shown. As the center of the eccentric is displaced in the direction of the ring gap, the section of the ring near the gap becomes attenuated and is weakened enough to discourage it from acting as indicated in diagram B. Absolute uniformity of bearing pressure is of course not attained by this method because that would make it necessary to taper the ring tips i (A) down to zero thickness. Nevertheless, a degree of uniformity adequate for practical purposes is attained by this method and the ring eccentric has many applications. However, it appears to have a serious drawback when used in oil engines, for reasons which are to be discussed.

The curvature of a uniform-section ring Fig. 75 B, may also be corrected by peening it on the inside as indicated at C. By looking at j (diagram B) it would seem as though peening the ring on the inside would still further increase the curvature at the very point where a decrease would actually be desirable. As a matter of fact, no attempt is ever made to correct a ring which has a shape like that shown at B by means of peening. In rings made by the peening process the curvature in the neighborhood of q (diagram C) is already correct, and little or no peening is done there. At the point p, opposite, the peening is a maximum and tends to give the ring some such shape as that indicated by the curve o. By a proper gradation of the peening around the circumference it is possible to give the ring such a tension that when it is sprung into the cylinder it will bear against the surface with a highly uniform pressure. In the diagram C the dots shown on the flank of the ring are intended to indicate the distribution and do not imply that that is the place where the peening is actually done.

There appears to be good reason for employing peened rings for oil engines rather than those of the eccentric type. A peened ring such as is commercially available is shown in Fig. 76.

In proportioning rings an effort is generally made to give them the largest possible radial depth in order that they may exert the maximum force on the cylinder walls. But if the radial depth is greater than 1/28 or 1/30 of the working size, the ring is too apt to break while stripping it over the outside diameter of the piston; at the depth indicated a ring will exert about 5 lbs. per sq. in. pressure, which experience has shown to be sufficient.

Those who have observed the indications which tend to show that the gas-pressure force which urges the rings against the bore far exceeds the original spring force may have

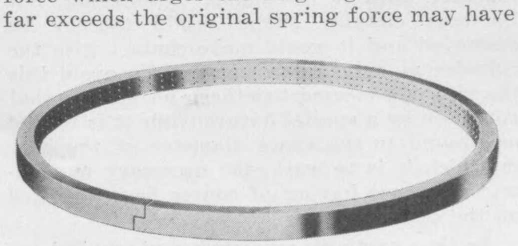


Fig. 76. Hammered piston ring

wondered why it is necessary to pay so much attention to the latter. Others who have not concerned themselves much with the subject may just as well be skeptical as to the force ascribed to the gas. As the ring is more or less completely surrounded by gas under pressure there would appear to be no good reason why the pressure should urge it against the cylinder any more than against the bottom or the sides of the ring groove.

As a matter of fact the gas can penetrate less readily between the outer ring surface and the cylinder wall than it can between the sides of the ring and the groove. The outer surface is given a glassy polish by the rapid motion over the cylinder wall and makes intimate contact with it.

Everyone who has accurately scraped two metal blocks together know that they have a tendency to "suck" or stick together. This may be readily explained by reference to Fig. 77, in which a' b' c' purports to be a microscopic cross section of the air space which remains between the scraped surfaces. No matter how perfectly the scraping may have been done, high and low spots such as a' and b' still remain, and a certain amount of air penetrates into the latter. There the air exerts pressure tending to urge the blocks apart, just as the air on the outside of the blocks tends to keep them together. The more contact spots there are such as c', the fewer are the air pockets and the less the aggregate pressure exerted by the between-surface air. Probably the

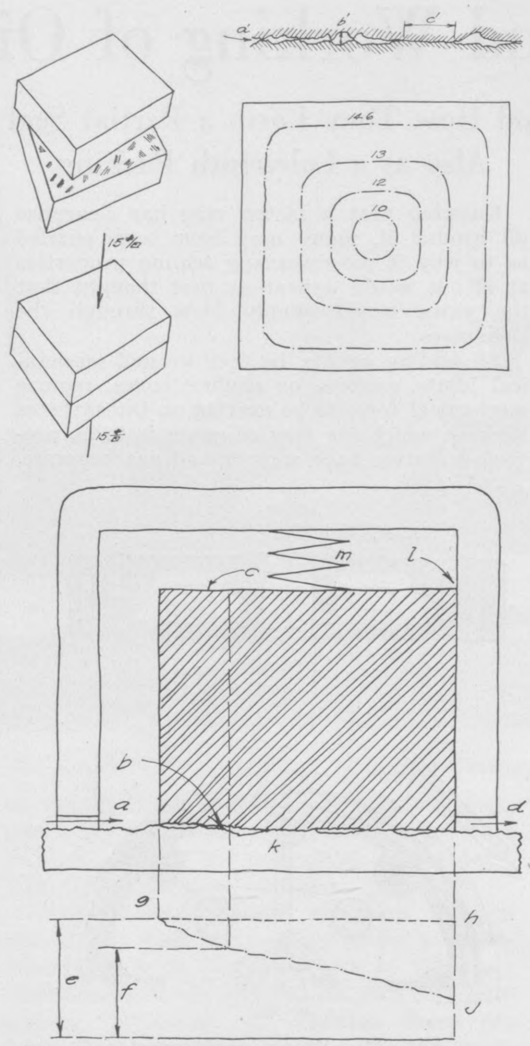


Fig. 77. Diagram of ring surface pressure

pressure is a minimum near the center of the surfaces in contact and is practically atmospheric near the edges.

At c, Fig. 77, is shown a block surrounded by the pressure a and bedded in by means of scraping against a plate k; let it be assumed that no gas can escape either at l or along the front and back sides of the block. The light spring m prevents the gas from flowing freely into b. In leaking through the interstices b towards the opening d the gas suffers a drop in pressure as represented by the curve g-j, while the opposing pressure at c remains undiminished at the full value of a over the entire length g-h. At any point such as b the two curves g-h and g-j show a difference in pressure to $e - f$, urging the block against the surface k. If there were a series of blocks arranged so that the leakage d from any one of them would flow around the succeeding one, it is conceivable that there would not be much left of the original pressure a after the gas emerges from the last block in the series. Each of the blocks would be pressed down by an excess of force proportional in each case to the area g-h-j.

The applicability of this reasoning to the action of a piston ring is readily apparent and may be rendered additionally clear by reference to Fig. 78. Gas flowing around the head of the piston and through the circumferential clearance suffers a drop in pressure (diagram A, curve r-s-t-u-v) as it leaks past ring No. 1, No. 2, etc., until at No. 6 it is no longer blowing enough to be apparent in the engine room. At the point r, which represents the upper edge of the top (No. 1) ring, the full pressure from the combustion space has established itself, but by the time the gas has flowed past the ring and through the end gap to the point represented on the curve by t its pressure has suffered a drop to, say, 400 lb. per sq. in.

Owing to the relatively large size of the annular space i between the solid body of the piston and the cylinder wall, the gas probably passes across it with no appreciable drop in pressure until it comes to the upper edge of ring No. 2, which causes the pressure drop represented by u-v-w. This process continues until at the last ring, say No. 6, the gas is flowing at a pressure far less than that which is found in the combustion space. Because of the large total flow resistance which the rings oppose to the passage of the gas—while no single one of them may be considered a positive barrier—their action may very correctly be compared to that of a labyrinth.

The curve r-s-t-u-v also suggests the explanation as to how the gas pressure assists in forcing the ring against the cylinder wall, a process of which the observed wear (Fig. 79) gives ample evidence. Mechanical

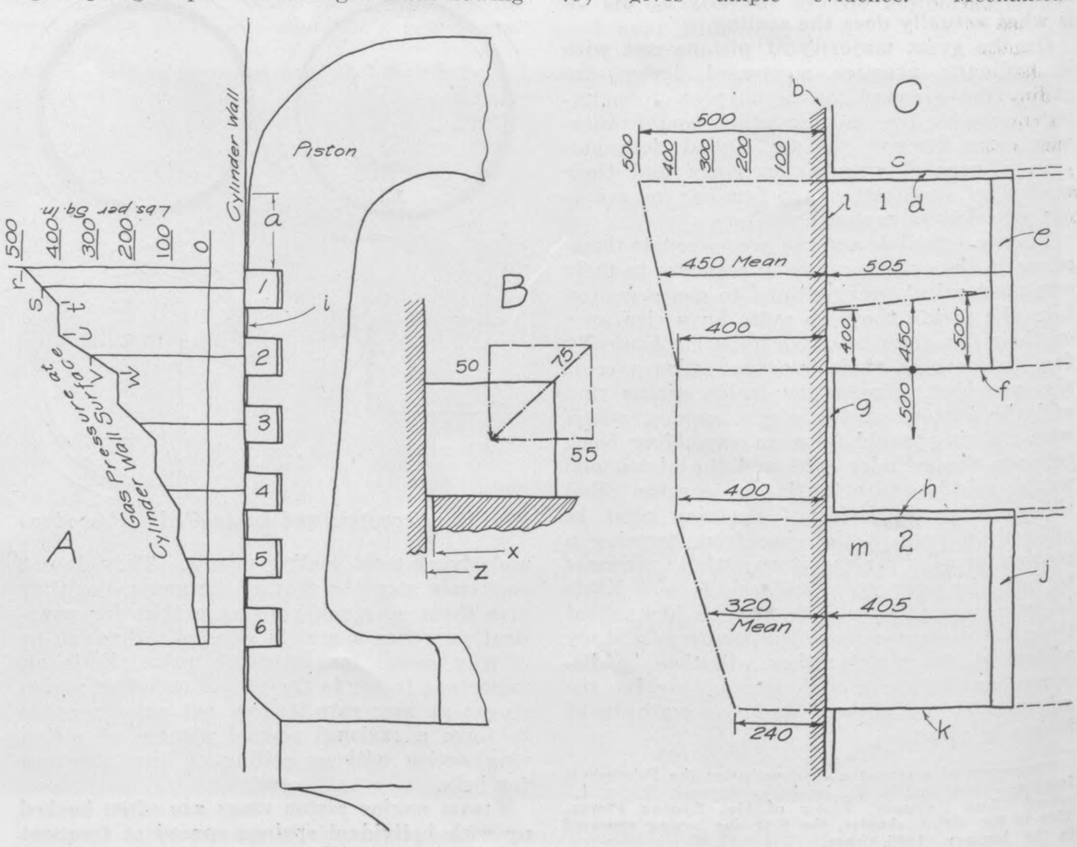


Fig. 78. Diagram of piston ring action

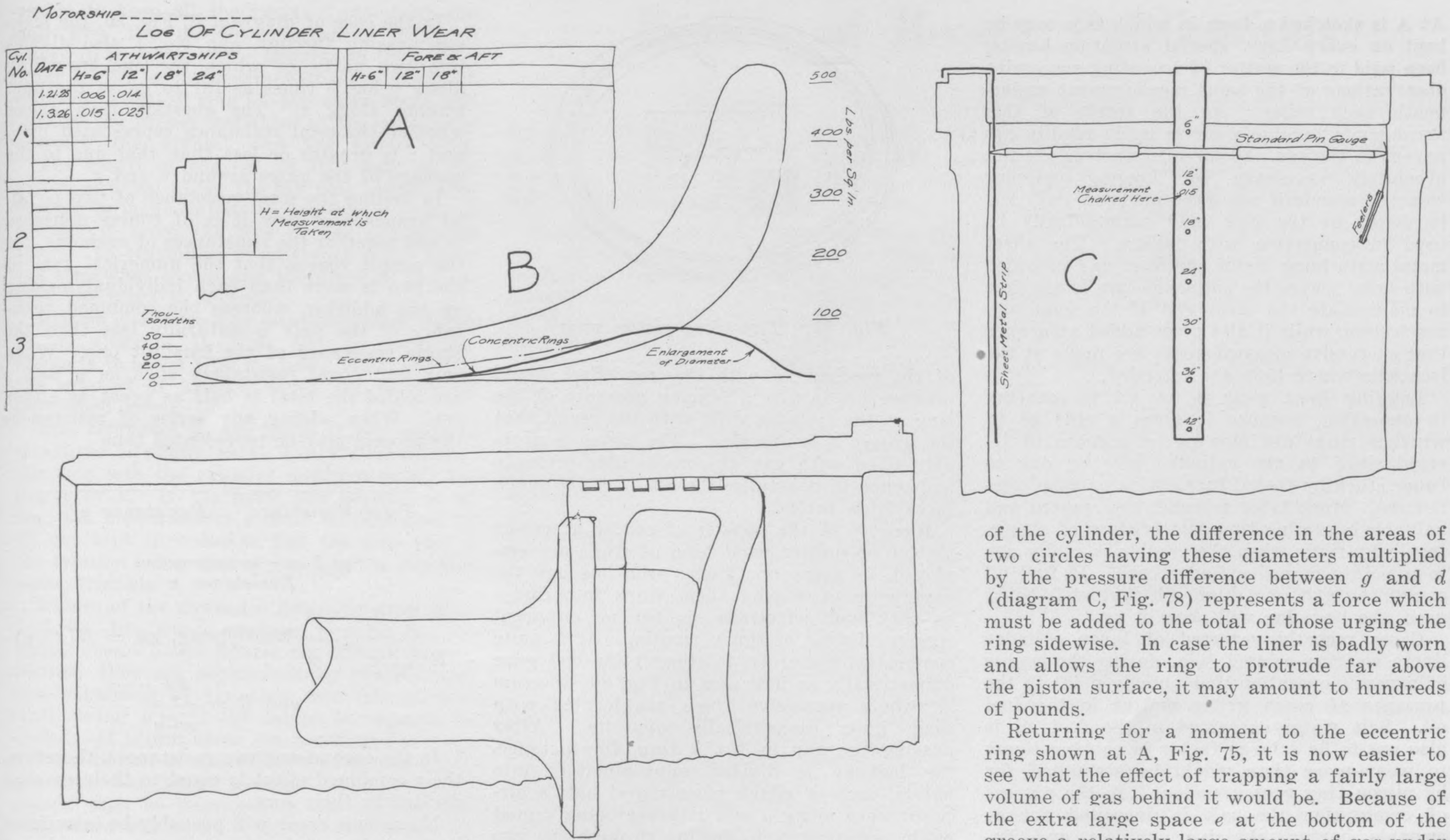


Fig. 79. Liner wear and log of cylinder measurements

"spring" amounting by itself to only 5 lb. per sq. in. would not account for scouring away ⅛ inch from the bore of a 24-inch hard cast iron liner in the course of a year's operation.

Take for example, ring No. 1, on the working surface of which we will assume the pressure to have dropped from 500 lb. (r, diagram A, Fig. 78) to 400 lb. at the point t. From diagram C, redrawn to a more convenient scale, it is apparent that the full combustion pressure of 500 lb. per sq. in. gets on top of the ring via the side clearance shown exaggerated at d and thence to the clearance e at the bottom of the groove. But on the glassy surface l the gas cannot penetrate very far before the great resistance of this path begins to reduce its pressure, with the result that it may have been lowered to some such value as 400 lb. before escaping into the piston clearance g. The mean pressure between the surfaces would then be around 450 lb., i.e. 50 lb. less than that of the gas at the bottom of the groove which is urging the ring outwards. In combination with the original 5 lb. due to the elasticity of the ring this yields a net force of about 55 lb. pressing the ring against the cylinder wall.

Whereas the ring tension thus amounts to little in comparison with the gas pressure force, it is apparent also that the gas force would not have come into action at all if the mechanical pressure had not been there in the first place to cause an impeded gas flow along l.

Much the same thing occurs along the surface f, against which the ring is urged in the first place by the backward drag of the cylinder wall as the piston travels upward on the compression stroke. Some idea of the intensity of the force with which the ring is urged sideways may be had by inspecting diagram C, Fig. 80, where a groove p is shown enlarged as the result of this action. In such cases ridges q and r are found both on the ring and in the groove, a difficulty which is not overcome simply by fitting an oversize ring. The piston should be chucked in a lathe and the ridge removed by facing, otherwise it may jam the ring as shown at s.

The pressure varying along f (Fig. 78) from 500 to 400 as indicated would have a mean value of only 450 lb. per sq. in., opposed by 500 lb. on the top side. This would leave a net difference of 50 lb. per sq. in. for the force urging the ring against the side of its groove. In diagram B the lateral and radial forces have been combined into a single force of 75 lb. represented as urging the ring into the "corner" formed by the side of the groove and the wall of the cylinder. As a matter of fact the lateral force is more than the 50 lb. indicated, for the reason that there is a certain unbalanced pressure acting on that part of the ring which protrudes above the outside diameter of the piston body. If x (diagram B) represents the piston diameter and z that of the cylinder, the difference in the areas of two circles having these diameters multiplied by the pressure difference between g and d (diagram C, Fig. 78) represents a force which must be added to the total of those urging the ring sidewise. In case the liner is badly worn and allows the ring to protrude far above the piston surface, it may amount to hundreds of pounds.

Returning for a moment to the eccentric ring shown at A, Fig. 75, it is now easier to see what the effect of trapping a fairly large volume of gas behind it would be. Because of the extra large space e at the bottom of the groove a relatively large amount of gas under pressure may be stored there while the piston is receding on the expansion stroke. Although the pressure on top of the piston is therefore rapidly being lowered, the ring continues to be urged outward by the gas behind it for a longer time than is necessary, causing unduly rapid wear both on itself and on the liner.

A suggestion of this condition is given in diagram B, Fig. 80, showing two curves of liner wear plotted along the longitudinal cross section. Corresponding to the heavier pressure near the upper end, the wear in that neighborhood is correspondingly greater, but it continues farther down the bore when eccentric rings are employed than when those of uniform section are used.

Fig. 80 also illustrates a method for systematically logging liner wear, which should be made a part of the routine of each overhaul.

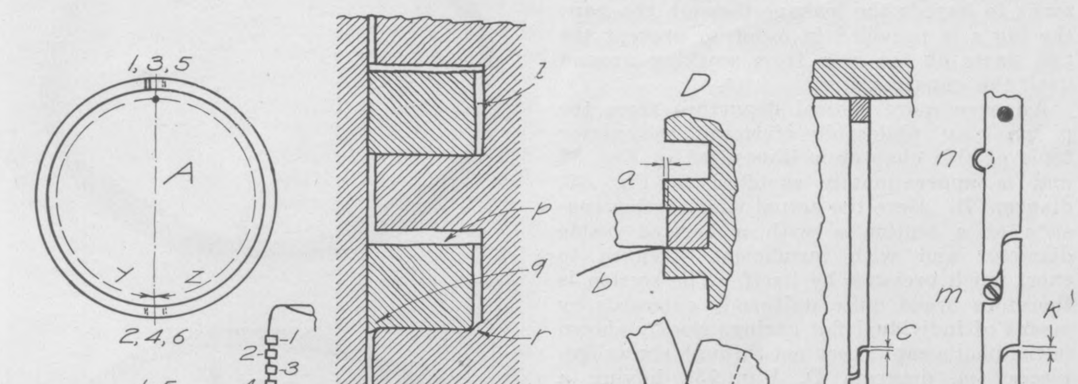


Fig. 80. Sketches of piston ring grooves and gaps

At A is sketched a form in which tabs may be kept on every liner, special attention having been paid to the matter of recording successive observations of the same measurement underneath each other. As the result of this arrangement undue wear is made readily apparent to the eye. Inside micrometers are not absolutely necessary for logging cylinder wear; a standard pin gage made of drill rod hardened at the tips may satisfactorily be used in connection with feelers. The sheet metal strip hung inside the liner and provided with holes leaves the engineers two hands free to manipulate the other end of the gage and the feelers, while it also gives added assurance that successive measurements are made at the locations where they are intended.

Logging liner wear is an aid to economy in operation, because it gives a clue as to whether rings are blowing on account of irregularities in the cylinder bore or due to being stuck by fouled lubrication or poor combustion. Much labor is sometimes wasted and valuable operating time lost because of changing leaky rings when the trouble is really due to a potato-shaped cylinder bore. If fuel oil containing grit or a high ash content is being used, the liner log will show it up.

Cases recently reported of large cylinder liners wearing around ¼ in. during the course of a year's operation undoubtedly point to the presence of much gritty matter in the fuel oil. Salt water entrained in the fuel oil is also apt to be a large factor in causing liners to wear more than would be accounted for by piston ring pressure alone. In the process of combustion the salt is deposited out as crystals having abrasive qualities and impairing the value of the cylinder lubricating oil. Keeping the rivets of double-bottom fuel tanks tight probably belongs to the ABC of reducing liner wear, and when fuels rich in grit are being consumed centrifugal purification is suggested as a further safeguard.

With the "philosophy" of piston ring action as thus outlined not all engineers and manufacturers will necessarily be found in agreement. Apparently the designer of the ring shown in Fig. 81 did not take much stock in labyrinth action, because the entire ring is built around the idea that the biggest part of the leakage takes place around the end gap.

Accordingly the ring is made up of an angle-sectioned part b so dimensioned as to spring against the cylinder bore like an ordinary ring, while a rectangular-sectioned ring a is laid into it without tension. It bridges the gap between the butt-ends of the angle ring and tends to impede the leakage through the gap; the lug c is provided in order to prevent the two parts of the ring from working around until the gaps register.

An even more radical departure from the piston ring philosophy forming the major topic of this chapter is illustrated in Fig. 82 and is approximately sketched in Fig. 75, diagram D. Here the actual ring portion consists of a section n with a beveled inside diameter and with insufficient strength to exert much pressure by itself. The section is therefore urged quite uniformly outwards by means of individual flat springs clearly shown in the photograph; they act through six wedge-pieces (m, diagram D, Fig. 75) having a bevel corresponding to that of the main ring. While being pushed outwards by the spring force r the wedges tend to ride up on the bevel of the ring, which is thus pressed into the corner with the force aa. Although the wedges react on the side of the groove x with the force w, no sealing action probably takes place there, because of the numerous fairly large gaps between the individual wedge pieces.

It is at once apparent that this arrangement is intended to produce by mechanical means the condition which is attributed to gas pressure as explained by diagram B, Fig. 78. It would seem as though the combination

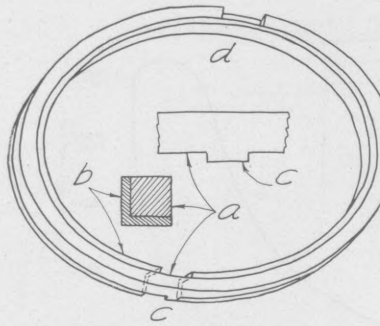


Fig. 81. Two-piece piston ring

of the mechanical with the gas effect would produce too intense a bearing pressure of the ring on the cylinder wall, with the result that the groove u is provided. The latter is probably filled with gas at considerable pressure and tends to neutralize the effect of too much force from behind.

Registry of the gaps is of course a serious matter no matter what kind of rings are employed, as every one knows who has had the experience of having them work into line—as they will sometimes do for no apparent reason—during ordinary running. It is quite customary, therefore, to stagger the end gaps diametrically as indicated in Fig. 80, diagram A, where successive rings are located with their gaps diametrically opposite. After passing the gap in No. 1 ring, for instance, the leakage is divided approximately into halves, each of which must travel half a circumference along y and z before being united again preparatory to flowing through the gap in ring No. 2. The combined resistance, or labyrinth effect, along the two paths is of course one-half as great as it would be if all the gas would have to travel along only one of the semi-circumferences.

Some engineers prefer to "step-stagger" the rings in such a way that the gap of any one ring is 90 deg. further around the circumference than that of its predecessor, as sketched at B, Fig. 80. It is thereby intended to make the leakage travel in something like a "spiral" path of great length and resistance; it is not altogether certain that the "step-stagger" really provides more resistance.

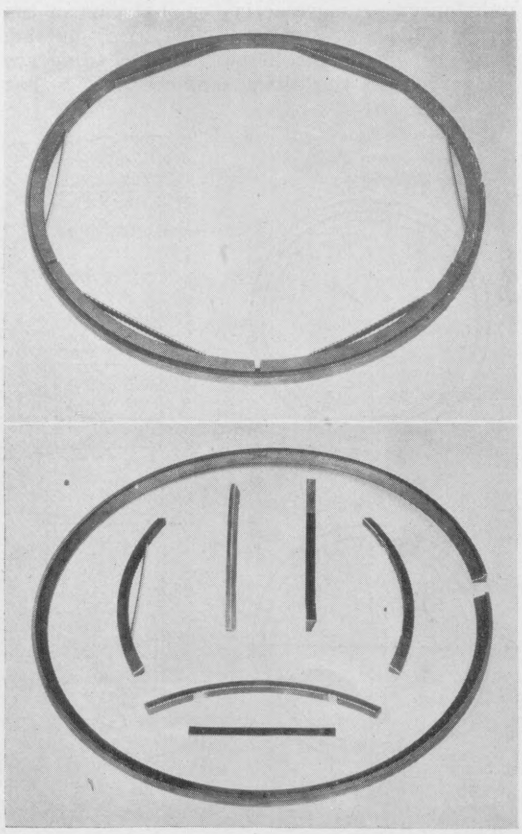


Fig. 82. Wedge-type piston ring

In the case of diagram B, Fig. 80, the leakage passing through gap No. 1 also divides into two parts, of which the one travelling along v has 3 times as far to go as the part leaking along x. The question then arises whether the total resistance represented by y and z is greater or less than that due to the passage of the gases around v and x.

In finding the total resistance of two parallel branches of flow it is of course nonsense to add together the resistances of each one, for the simple reason that the numerical sum of the two is more than each individual making up the addition, whereas the combined resistance of the pair is naturally less than the single resistance of the smallest one. When only two equal resistances such as y and z are added the total is half as great as either one. When adding any series of resistances the process may be represented thus

$$\frac{1}{\textit{Total Resistance}} = \frac{1}{\textit{Resistance } y} + \frac{1}{\textit{Resistance } x}$$

$$\frac{1}{R} = \frac{1}{x} + \frac{1}{y} \quad \text{Multiplying, } xy = R(x+y)$$

$$\text{and } R = \frac{xy}{x+y}$$

In the case of any two resistances, therefore, their combined effect is equal to their product divided by their sum.

No serious error will probably be introduced by regarding the resistances y, z, x, and v of Fig. 80 (A and B) as proportional to the arc lengths of the ring grooves in which they are found. In that case the value 2 might be assigned to y and z with 1 for x and 3 for v.

Applying this to the diametric gap stagger indicated at A there results

$$\frac{2 \times 2}{2 + 2} = \frac{4}{4} = 1$$

as the equivalent of the resistance encountered by the gas in flowing from one gap to the next.

In the case of the step-stagger of diagram B this resistance amounts to

$$\frac{1 \times 3}{1 + 3} = \frac{3}{4}$$

or 25 per cent less than that of the diametric-stagger arrangement. It may also be shown that 1 is the maximum value which the combination can have and that any other grouping of the gaps (at 120°, for instance) will have a lower resistance.

Besides watching the gaps, an engineer engaged in fitting a set of rings should also satisfy himself that the three kinds of clearance already referred to are right. Burrs, feather edges, and every trace of dirt must first be eliminated and warped rings rejected. Each ring may be separately tried in the groove without stripping it on as shown at D, Fig. 80, while the side-clearance may be measured by means of feelers as shown at b.

The nearer a ring is located to the top of the group and hence to the combustion space the more clearance it requires on account of the increased amounts of carbon and combustion residues which are found there and which tend to make the rings work less freely. Too much side play is not objectionable so much from the point of view of leakage as from that of minimizing groove enlargement like that illustrated at C. The following side clearances have been found satisfactory:

Rings 1 and 2....0.006 in. — 0.008 in.
Rings 3 and 4....0.004 in. — 0.006 in.
Rings 5 and 6....0.002 in. — 0.004 in.

Individual cases may of course call for a modification of these figures. It appears pref-

erable to keep all the rings of standard size and give the varying clearances indicated above to the sizes of the grooves on the piston. That makes it unnecessary to keep track of different sizes of ring in the store room and insures the proper variation of the clearances between the highest and the lowest ring.

The length *a*, Fig. 78, of that part of the piston situated above the top ring should preferably be made as long as possible in order to protect it from the fire of the combustion space. In travelling the distance *a* the gases are somewhat cooled and therefore do not attack the rings so severely.

Bottom clearance may be measured as shown at *a*, diagram D, Fig. 80. It generally amounts to about 1/64 in., being made small in the interest of keeping down the volume of entrapped gases.

End clearance at the butts of the rings is measured as shown at E, Fig. 80, by slipping the ring into the cylinder and measuring the gap *c* or *k*. If the butts are beveled at 45 deg. the measurement *e* must be increased by 40 per cent in order to find the true gap *f*, the relation being that of *j* to *h* in the isosceles right triangle.

Values of the clearance generally vary from 0.02 in. for small engines to 0.10 in. for larger ones. Exact figures are difficult to give because they are determined by the differential expansion of the ring and the cylinder wall, being less if the latter is imperfectly cooled. If bright spots are found on the butts after a period of operation they indicate that the ring has been "arching"; the clearance should then be increased to an amount such that there will be no touching, even after the ring and the cylinder wall have acquired their normal operating temperatures.

Rings are sometimes pinned as shown at *m* for the purpose of preventing the gaps from working around into line or opposite the ports in the case of a two-cycle engine. At *n* a semi-circular piece is shown spot-welded on the ring; it fits loosely into one half of a hole drilled part-way in the side of the groove.

With a reasonable amount of attention to the matters discussed in this chapter piston rings of oil engines do not present any serious operating difficulties.

Diesel Engine Research

Engineering educational institutions of this country have not fully realized the wonderful opportunities for conducting research work on Diesel engine problems. Many problems which cannot be handled or controlled in the average manufacturing plant could be most accurately studied in educational institutions by earnest minded students who hope to make the Diesel engine their life study. Relation of viscosity to fuel valve design would be of great value. Further knowledge of penetration and definite mathematical values and laws covering fuel penetration within the combustion space would greatly further the advance of the airelss injection engine. Any number of problems could be worked out for the benefit of the profession and the advancement of industry. The president of a large State university makes an important point in emphasizing the fact that the work of a university does not consist entirely of teaching by professors and of learning by students. The great centers of learning are great not by virtue of the number of their students, but by the quality of their research work and the value of the discoveries made. A small university may achieve world-wide reputation by the laboratorical or other research of its professors and students. In other words, a university should be a discoverer and not merely a distributor of knowledge, and a few students and professors may do more for it than a legion who have done no more than gain its diplomas.—C. G. A. R.

Review of Recent Publications

Motorships

By A. C. Hardy, B. Sc., A. M. Inst. N. A., A. M. I. Mar. E., A. M. N. E. C. Inst. 8¾ in. x 5½ in. 320 pp. Price 15 shillings. Published by Chapman & Hall, Ltd., London.

Many books have been published about marine oil engines. This is the first book on motorships, and in it oil engine matters are touched upon only in their relation to ships. As the sub-title explains, this book is "an investigation into the characteristics of mercantile vessels propelled by internal combustion engines." It is written by the author of "Merchant Ship Types."

Primarily intended for those in the shipping world who have not been in close contact with the progress of the motorship movement Hardy's book will be of great utility to those who desire to post themselves on the present development of motorships. It deals briefly with the various types of engines and with the auxiliary machinery as a proper introduction to its main theme, the arrangement of motorships and their operation.

To his subject the author brings a comprehensive knowledge. He has inspected nearly all the vessels he writes about, and through his association with the British magazines, *Marine Engineer & Motorship Builder* and *Shipbuilding & Shipping Record* has been in close touch with the trend of developments. His book is accordingly well-balanced and expressive of the motorship movement to date.

There are minor errors in the text, such as arise from hurried proof reading, but none of them are of real importance. We have examined the book very critically, and our judgment is that for a work of its nature—the first of its kind—it is a very commendable presentation. A book of this kind has been needed. Today it is a work of reference—in the future it will be a book of historical interest.

American Petroleum Supply and Demand

A report to the Board of Directors of the American Petroleum Institute by a committee of eleven members of the Board. 9¼ in. x 5¾ in. 270 pp. Price $3. Published by the McGraw-Hill Book Co., Inc., New York

Although the matters treated in this book are of the greatest national importance, the data collected by the committee to serve as the basis for its conclusions are doubtless of restricted interest. While everybody in the country is concerned in one way or another with the future petroleum supply and demand, there are very few who will care to follow the committee's preliminary investigation. The report in its complete form as now published is mainly of library interest.

There are two main sections to the book, one dealing with supply and the other dealing with demand. In the report on supply all the existing estimates of known reserves are considered and a review is made of the extent of territory which is probably oil bearing, but which has not yet been explored. An estimate is made of the oil that may possibly be recovered through new processes from wells that have ceased to yield or that give very little oil when pumped. The survey is then expanded to cover the possible yield of oil from shale, coal and lignite. The report on the future demand for petroleum products is based partly on facts and partly on assumptions. Some of the assumptions such as that concerning the growth of population are so closely tied to well-grounded laws that there is little chance for significant error to creep in. Others, such as the rate of conversion from steam to Diesel electric driven generators are highly speculative.

Throughout the report references are made to the sources of information used or to the authorities quoted. In all places where assumptions are made they are clearly indicated as assumptions. The predictions which the committee has thus been enable to make concerning the future demand can be regarded as established upon pretty firm bases within fairly well defined limits or errors. It is estimated, for instance, that all fuel oil burning vessels will be transformed to Diesel equipment at a rate that will result in a complete Diesel driven merchant marine and navy by 1965. The underlying fact of the transformation will be accepted by all those who are conversant with the present tendency in marine propulsion, but there is, of course, considerable room for differences of opinion about the date when that transformation will have been completed. So it is with many of the other predictions which the committee was forced to make in order to arrive at its conclusions. A number of charts illustrate the estimates.

The Ports of Jacksonville, Fernandina, Miami, Key West, Tampa, and South Boca Grande, Florida

Port Series No. 8. Prepared by the Board of Engineers for Rivers and Harbors, War Department, in coöperation with the Bureau of Research, U. S. Shipping Board. 9 in. x 5¾ in. 309 pp. and plates and maps. Price $1.10. Sold by the Superintendent of Documents, Government Printing Office, Washington, D. C.

This volume of the series contains mosaic illustrations of ports made from aerial photographs. These pictures are more effective than maps, because they not only have the scale feature of maps, but have a pictorial accuracy of the surroundings which the camera can give but which maps cannot possess.

The ports of Florida have, in the past, been conspicuous for their heavy shipments of phosphate, lumber and naval stores. This trade still flourishes, but the last few years have witnessed a change in the nature of the ocean-borne business.

The business of Jacksonville was formerly confined mainly to a few crude commodities, principally fertilizer inbound and lumber and naval stores outbound. As a result of more favorable railroad rates to and from the producing and consuming sections of the country and of the provision by the city of terminal facilities suitable for handling general traffic, there has been a conspicuous increase in through business.

Tampa holds first position in the shipment of rock and pebble phosphate. It is also an important outlet for lumber, and in recent years has become an important distributing center for petroleum products. The foresight of the local authorities in providing modern terminal facilities has already been instrumental in inducing a greater flow of traffic.

The most pronounced increase in Florida port business has been witnessed in Miami, where the traffic grew from 206,000 tons in 1922 to 776,000 in 1923, and 1,105,616 tons in 1924. This marked increase has been made possible through the combined efforts of the Federal Government in providing a ship channel and of local interests in building a modern municipal terminal. The development is a natural outcome of the spectacular growth of population now taking place in the lower section of Florida, and which seems likely to continue. The progressive attitude of the local interests at Miami gives splendid assurance

that facilities will be increased from time to time in keeping with the requirements of commerce.

Key West occupies a particularly favorable position for trade moving to and from the Island of Cuba, the larger share of which is over car ferries of the Florida East Coast Railway.

Fernandina and South Boca Grande are conspicuous for their large shipments of phosphate.

Full information with regard to conditions, regulations, customs, charges, and facilities are given for each port.

Personal Notes

Rear Admiral David W. Taylor, U. S. N. (Ret'd), formerly Chief Constructor and for many years head of the Bureau of Construction and Repair of the Navy Department, has become associated as consultant with the firm of Gibbs Bros. Inc., Naval Architects, No. 1 Broadway, New York, N. Y.

D. V. Stratton has resigned from the presidency of the New York Harbor Dry Dock Co., Inc., in order to join a syndicate interested in a development project on the east coast of Florida.

Marvin A. Neeland, president of the New York Shipbuilding Corporation, sailed early last month for Europe, to visit Brown, Boveri & Co., of Baden, Switzerland, a big electrical manufacturing firm, which plans to enter the American market by purchasing the plant of the New York S. B. Co., at Camden, N. J.

Catalogs

Marine Diesel Engines. Prospectus 13. A 24-pp. illustrated catalog of the Werkspoor engine, containing a list of ships equipped with Werkspoor engines. Werkspoor, Amsterdam, Holland.

Who Will Enlighten Him?

At a meeting of engineers, the name of which would contribute nothing more to what is to follow than would the name of the speaker, we heard a man arise and say:

"Speaking as a steam engineer, I have been somewhat surprised, after hearing the experts tonight, to find that there are other troubles associated with the oil engine, in addition to maneuvering difficulties. In view of the earlier papers we have had I should like to ask whether it is any defect in the cooling system which causes overheating. In the oil engine the temperatures reach a very high figure; therefore, if the cooling water is not circulating sufficiently, trouble follows immediately. It has been confessed at times that the cylinders do get red hot. I know something about piston rings, but, while I can not make any useful suggestions about the trunk pistons, I think it might be possible to get over the difficulties if you could make a counterbore in the cylinder liner. The liner is generally of a harder nature than the cylinder and you get a slight wear. I might suggest that you have a solid piston altogether. The draught through the rings is so small that this suggestion might be practicable."

Aside from a few muffled coughs, there was nothing less polite made as a reply to the speaker than one gruff voice in the rear of the hall which rumbled out "Well, I'll be damned if I know!"

Carbon on the air compressor valve always indicates that the compressor is getting too much oil and sometimes indicates that it is not getting enough attention.

Recent Technical Reports and Addresses

Diesel Engines in Submarines

By E. C. Magdeburger, Bureau of Engineering, Navy Department, Washington, D. C. Published in the Journal of the American Society of Naval Engineers, Washington, D. C.

This comprehensive historical survey of the use of Diesel engines in United States submarines was originally presented as a paper before a joint committee of the engineering societies at Washington, D. C., during Oil & Gas Power Week, April 20-25 of this year. The first Diesel engines installed in the United States submarines were of the Vickers air injection type. They were 4-cylinder 4-cycle sets, non-reversible and without air starting, installed in the E-1 and E-2, commissioned February, 1912. Six-cylinder engines of similar design were installed in the F-class of submarines commissioned in the summer of 1912. The next type adopted by the United States Navy was the M. A. N. 2-cycle engine installed in the H and K classes of submarines commissioned during 1914. With some modifications the same type of engine was used for the L-class and a still further modification for the M-1. Sulzer engines were first tried in the G-3, and though the results obtained with it were scarcely more satisfactory than those obtained from the Vickers and M. A. N. type engines, nevertheless they led to the development of the Busch-Sulzer type. The 300 b.hp. engines of this latter make outlived the first hulls in which they were installed and were used later to replace some of the M. A. N. engines. With the introduction of the Nelseco 4-cycle engine there was a considerable improvement in operating efficiency. These were first installed in the N-type boats and were later used in re-engining the H and K classes and also some of the D boats and E boats. They were well liked by the navy personnel, and the first ones are still in service today in the boats at the Submarine School. Owing to the success of these first engines, different sizes of a similar design were built for the O and R classes, commissioned in 1918 and 1919 and these are all still in service. Busch-Sulzer engines were used in some of the O, R and S boats. These too stand up well in the service and have many friends. In the S-1 Nelseco engines were installed, in the S-2 Busch Sulzer, and in the S-3 the Brooklyn Navy Yard type of engine copied from the Augsburg 4-cycle type. In one of the T-class submarines two German built engines are being installed developing 2350 b.hp. at 345 r.p.m. In the V-class submarines the Busch-Sulzer engines are rated at 2500 b.hp. at 325 r.p.m. What the failures were in the early engines and what troubles had to be overcome in the later engines are fully recounted in this complete historical review.

Viscosity Standards

Report of the American Petroleum Institute. Published by the American Petroleum Institute, New York.

In this report are embodied the recommendations made by the A. P. I. committee on viscosity standards for Saybolt Universal and Furol Viscosimeters. The work was carried out in conjunction with the Bureau of Standards, Washington, D. C., and the recommendations have been incorporated in a proposal of the American Society for Testing Materials. The committee feels that the question of standardization and operation of the Saybolt Universal Viscosimeter is now in satisfactory form and that a convenient method is now available for the oil industry to check up all its instruments, so that in the future no serious discrepancies will occur in reported results.

Standards of the Hydraulic Society

Third Edition. By the Hydraulic Society, 90 West Street, New York City.

The Hydraulic Society comprises among its members all the leading pump manufacturers. It was formed to encourage standards of manufacture for the pump industry and to assist in the development of standard methods of pump procedure. The recommendations adopted include a standard classification of pumps, standard nomenclature and definitions pertaining to the industry, certain standard dimensions for cast iron flanges and a very complete list of chemicals and their special liquids, specifying the material recommended for the manufacture of pumps handling these special liquids. This book has been published for the benefit of consumers as well as manufacturers.

Pyrometry of Exhaust Temperatures of Internal Combustion Engines

By Charles E. Foster. Published by the Diesel Engine Users' Association, London. Price 7 shillings.

Pyrometers as an aid to the operating engineer are being more and more widely studied. If a pyrometer system is installed enabling the engineer to read the temperature of the exhaust from each cylinder in turn he is likely to obtain an intimation of impending trouble by the warning of a change in the exhaust temperature. This is the subject that Mr. Foster deals with in his paper. One of the most valuable contributions to the literature on this subject is the discussion following Foster's paper and the author's reply.